Nil
15-12-59

COMMONWEALTH BUREAU OF HELMINTHOLOGY,
THE WHITE HOUSE,
103, ST. PETER'S STREET,
ST. ALBANS, HERTS.
4.12.59.

Vol. 42, No. 2, 1959

THE MALAYAN AGRICULTURAL JOURNAL

PRINCIPAL CONTENTS

THE RAMBUTAN, A DESCRIPTION OF THE CHARACTERISTICS AND POTENTIAL OF THE MORE IMPORTANT VARIETIES. *By C. Whitehead.*

COMMERCIAL FRUIT NURSERIES IN PERAK. *By T. R. Dickinson.*

PHYTOPHTHORA PALMIVORA—A PARASITE OF ORCHIDS IN SINGAPORE. *By Aldworth Thompson.*

A DESCRIPTION OF EXISTING PRACTICES IN THE CULTIVATION OF MANDARIN ORANGES IN TELOK ANSON AREA. *By R. J. R. Barrett.*

MASTER FARMERS OF MALAYA, X. YIP WAH. *By T. Sockalingam.*

NOTES ON CURRENT INVESTIGATIONS AND EXTENSION WORK, APRIL TO JUNE, 1959.

MINISTRY OF AGRICULTURE, FEDERATION OF MALAYA,
Kuala Lumpur.

PRICE $2

DEPARTMENT OF AGRICULTURE, FEDERATION OF MALAYA

ORGANIZATION (as on 30th June, 1959)

Director of Agriculture:—A. L. Barcroft, B.Sc. (Agric.) (*Acting*).
Deputy Director of Agriculture:—G. S. Keeping, B.Sc., Dip. Agr. Sci (Cantab.). (*Actng*).
Higher Executive Officer:—Yap Sin Hee (*Acting*).
Executive Officer:—K. Nagapen.
Financial Assistant:—V. Sundram.

RESEARCH BRANCH

Assistant Director (Research):—
F. N. G. Conaty, B.Sc. (Hons.), A.R.I.C.

(II) BOTANY

Senior Botanist:—
A. V. Haddon, B.Sc. (Hons.), Dip. Agr. Sci. (Cantab.) (*Acting*).

Plant Breeders:—
Van Thean Kee, B.Sc. (Hons.).
A. Santiago, B.Sc. (Malaya), M.Sc. (Alta.).
Tang Teng Lai, BA, Dip. Agr. Sci. (Cantab.).

Plant Physiologist:—
One vacancy.

Asst. Research Officer:—
Sulan bin Salleh.

(III) CHEMISTRY

Senior Chemist:—
G. W. Arnott, B.Sc. (Hons.), D.T.A.

Canning Officer:—
One vacancy.

Chemists:—
Two vacancies.

Assistant Chemist:—
One vacancy.

(IV) SOIL SCIENCE

Senior Chemist (Soils):—
A. R. McWalter, B.Sc. (Hons.).

Chemist (Soils):—
K. Kanapathy, B.Sc. (Hons.) (Annamali), M.Sc., A.R.I.C.
K. T. Joseph, B.Sc. (Hons.), M.Sc.

Geologist (Soil Survey):—
W. P. Panton, B.Sc. (Hons.), D.T.A.

Asst. Research Officer:—
S. Thamboo.

FIELD BRANCH

Assistant Director (Field):—
Vacant.

Senior Agricultural Officer, Headquarters:—
Mohamad bin Jamil, B.Sc., D.I.C.T.A. (*Acting*).

Agricultural Economist:—
T. B. Wilson, M.A. (Hons.), (Oxon.), Dip. Agric. Econ., D.T.A.
S. Selvadurai, B.A. (Hons.). (*On study leave*).

Personal Assistant to Asst. Director (Field):—
Yoon Weng Kong.

KEDAH: *State Agricultural Officer*:-
J. L. B. Hitchcock, B.Sc. (Dunelm.) (*Acting*).
Agricultural Officer:—
Vacant.
Asst. Agricultural Officers:—
Othman bin Mohd. Lela.
Muhammad bin Arshad

PERLIS: *State Agricultural Officer*:—
Mohd. Noor bin Wahab, B.Sc. (Agric.) (Dunelm.).

KELANTAN: *State Agricultural Officer*:—
L. A. Vivian, B.Sc., Dip. Agr. (Cantab.), D.T.A. (*Acting*).
Agricultural Officer (Vacant).
Asst. Agricultural Officer:—
Hj. Mahmood bin Haji Yaacob, S.M.K.

TRENGGANU: *State Agricultural Officer*:—
Basir bin Ismail, B.Sc., (Agric.), (Dunelm.).
Asst. Agricultural Officer:—
Mohd. Noor bin Haji Abdul Hamid.

PENANG & PROVINCE WELLESLEY:
State Agricultural Officer:—
Ahmad bin Mohd. Amin, B.Sc. (Agric.).
Asst. Agricultural Officer:—
Mohd. Noordin bin Mohd. Kassim.

PERAK: *State Agricultural Officer*:—
T. R. Dickinson, P.J.K., B.Sc. (Agric.), Dip. Agr. (Cantab.) D.T.A.
Agricultural Officers:—
Perak North—
Wan Mohd. Don bin Mohamad, B. Agr.
Perak Central—
Zawawi bin Hamzah, B.Sc. (Agr.).
Perak South—Vacant.
Asst. Agricultural Officers:—
Mohd. Ibrahim bin Mohd. Ali.
Shahidin bin Mohd. Hassan

(Continued)

RESEARCH BRANCH (contd.)

(V) Entomology

Senior Entomologist:—(*Vacant*).

Entomologist:—

Ahmad bin Yunus, B.Sc. (Hons.), B. Agr.

Asst. Research Officer:—

Kamardin bin Bahar, A.M.N.

(VI) Plant Pathology

Senior Plant Pathologist:—(*Vacant*).

Plant Pathologists:—

S. J. Navaratnam, B.Sc. (Hons.).

Ting Wen Poh, B.Sc. (Hons.).

AGRONOMY BRANCH

Senior Agronomist:—

C. Whitehead, B.Sc. (Hort.) D.T.A.,

Agronomists:—

R. J. R. Barrett, B.A. (Hons.), (Cantab.), Dip. Agric. (Cantab.).

G. I. M. Martin, B.Sc. (Agric.), Dip. Agric. (Cantab.), D.T.A., S.D.D.H.

Lee Sin Fook, B.Sc. (Agric.).

Aw-Yong Kong Keong, B.Sc., B. Agr. (Hons.). (North-West).

Ajit Singh Sidhu, B.Sc. (Punjab) Ph.D., (Durham).

Four vacancies.

Agricultural Engineers:—

Two vacancies.

Livestock Officer:—*Vacant.*

Statistician:—

I. Watson, B.Sc., (Hons.). (*On Contract*).

Asst. Statistician:—

Lee Yoke Heng.

Agricultural Development Officers:—

J. A. Cox, A.M.I.B.A.E.

A. I. Cumming, Ass. Mem. A.S.A.E., A.M.I.B.A.E.

Ahmad bin Jamal.

N. Kanagaratnam.

One vacancy.

Asst. Agricultural Officer:—

B. Rengaswamy.

PUBLICATIONS BRANCH

Publications Officer:—(*Vacant*).

Mrs. J. Wilson, B.A. (Hons.), (Oxon) (*Temporary*).

Librarian:—

P. J. Verghese.

FIELD BRANCH (contd.)

Selangor: *State Agricultural Officer*:—

H. D. Matheson, B.Sc., D.T.A.

Agricultural Officer, Coast (North):—

Vacant.

Asst. Agricultural Officer:—

Zakaria bin Abdul Rauf, P.J.K.

Pahang: *State Agricultural Officer*:—

Omar bin Buyong, B. Agric. (*Acting*).

Agricultural Officer:—*Vacant.*

Asst. Agricultural Officers:—

Pahang North—

Ng Ngok Wah.

Pahang East—

Mohd. Muda bin Mahmood.

Pahang South—

Vacant.

Agricultural Asst. i/c F.E.S.

Cameron Highlands—

T. Sockalingam.

Negri Sembilan:

State Agricultural Officer:—

G. F. Darnell, B.Sc. (Agric.), Dip. Agr. (Cantab.), D.T.A.

Asst. Agricultural Officer—Vacant.

Malacca: *State Agricultural Officer*:—

Mohd. Tamin bin Yeop, B.Sc. (Agric.).

Asst. Agricultural Officer:—

Hj Ali bin Mohd. Salleh.

Johore: *State Agricultural Officer*:—

P. Class, B.Sc. (Agric.), D.T.A.

Agricultural Officers:—

Johore Central—

Mohd. Ridzuan b. Mohd. Noh, B.Sc. (Belfast).

Johore West—Vacant.

Asst. Agricultural Officer, Johore South:—

Tan Guan Chye.

AGRICULTURAL EDUCATION BRANCH

Principal, College of Agriculture, Malaya:—

Chew Hong Jung, B.Sc. (Hons.), B. Agric.

Senior Lecturer:—

Khalid bin Abdul Rahman, B.Sc. (Agric.).

Registrar and Bursar:—

Yap Chin Hee.

Assistant Lecturers:—

G. R. Kurup, B.A.

Abdul Hamid bin Haji Hussein.

Haji Abu Hassan bin Sidong.

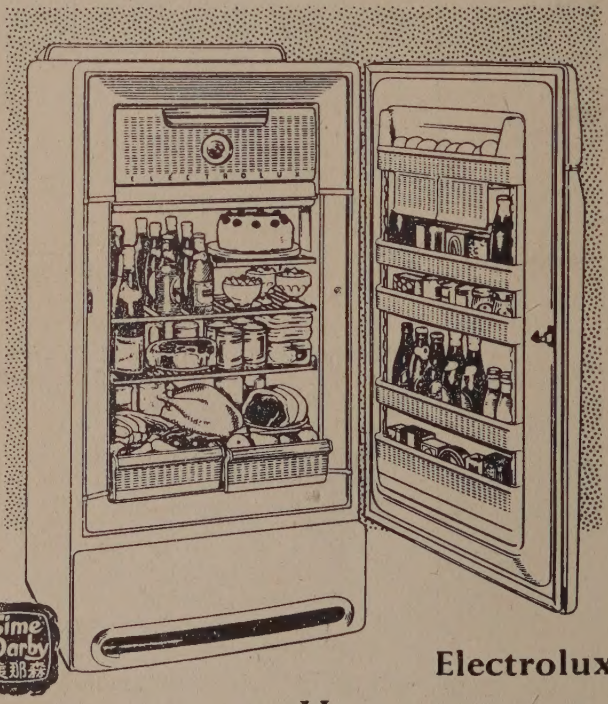
Abu Bakar bin Mohd. Tahir.

Tamin bin Hussain.

Mrs. V. Thomas, B.Sc., M.Sc. (Madras), (*Temporary*).

Mrs. M. Joseph, B.A. (Madras), (*Temporary*).

THE *VERY LATEST* Electrolux REFRIGERATOR



- *Capacity 7.6 cu. ft.*
- *Big frozen food compartment*
- *5 ice trays*
- *2 vegetable drawers*
- *Door rack for eggs, compartments for butter and cheese*
- *Adjustable door shelves*
- *For operation by kerosene or electricity*

Silent cooling unit guaranteed 5 years

Sime Darby 義和祥

Electrolux L.76

HERE is refrigeration in the grand manner. Luxuriously appointed with the most modern refinements, the new Electrolux L.76 has more than 14 square feet of shelf space, with every square inch carefully designed for practical use. Its lovely modern lines and delightful colour scheme will grace any kitchen or bar. You can depend on Electrolux too—the *original* silent refrigerator without moving parts . . . with the world-wide reputation for complete reliability. Come and see the range of models.

J163A

A simple choice

Good or bad trees—many factors decide the final yield, but one thing is certain, land for replanting must be cleared of lallang, or the growth of young trees is retarded and the yield reduced. The best and safest way to eradicate lallang is by spraying and wiping with . . .

SHELL LALLANG OILS

SHELL

Pest control – suddenly

To obtain immediate control of insect vectors of disease, a fine fog of insecticide dispersed over a wide area is the only answer. A fog is also effective in clearing a building of insects quickly.
The effective insecticide is *Dieldrex 15*, already proven in the Malay Peninsula.
The machine to provide the fog is . . .

swingfog

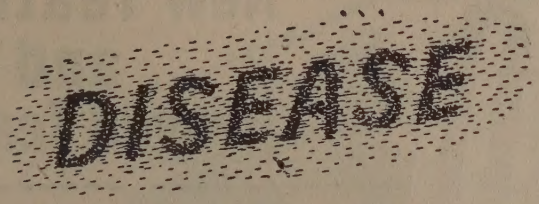
the versatile pulse-jet fogging machine. Portable, simple to use, thoroughly effective; hundreds are in use in Malaya. For details of independent trials conducted by public health authorities, write to Malayan Fertilisers Limited, P.O. Box 157 Kuala Lumpur; Sole Agents for Swingfog in this area.

SHELL

DIELDREX 15

the ideal estate insecticide.

ANY WATER CAN CARRY . . .



TERRIBLE DISEASES such as Cholera, Typhoid, Dysentery and many others are carried by water and have plagued MAN for centuries.

IT IS WELL TO REMEMBER that no water is safe—no matter how "CLEAR" it looks—unless due precaution has been taken to STERILISE it before drinking.

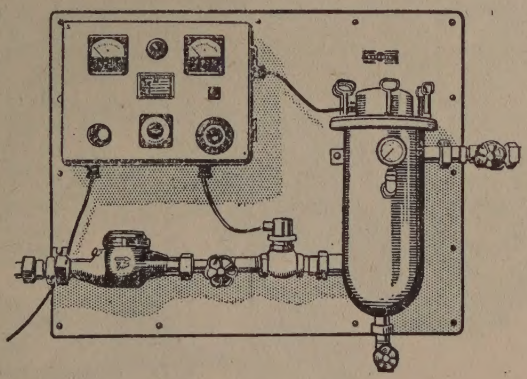
The latest Popular Technique is by passing it through

" ELECTRO - KATADYN "

WATER PURIFICATION PLANT (WORLD PATENTED)

because:—

1. It uses No Chemical, therefore free from pungent smell and taste, and is Non-Corrosive.
2. It is fully automatic and simple to use.
3. It is absolutely SAFE even if accidental overdosage occurs.
4. It produces highly activated water to resist re-infection.



5. It prevents Algae formation.
6. It is GUARANTEED that the treated water will correspond bacteriologically to British and American Standard of POTABLE Drinking Water.
7. It has output capacities from 9600 to 1,728,000 gallons per day or more.

For smaller capacities suitable for household use, ranging from 38 to 900 g.p.h. of SAFE WATER, the "KATADYN" FILLER/STERILIZER is available.

For your requirements, contact:

The Exclusive Agent and Stockist for
Malaya, Singapore, Br. North Borneo.

SPOTRADIO LIMITED

58, Orchard Road, Singapore, 9.

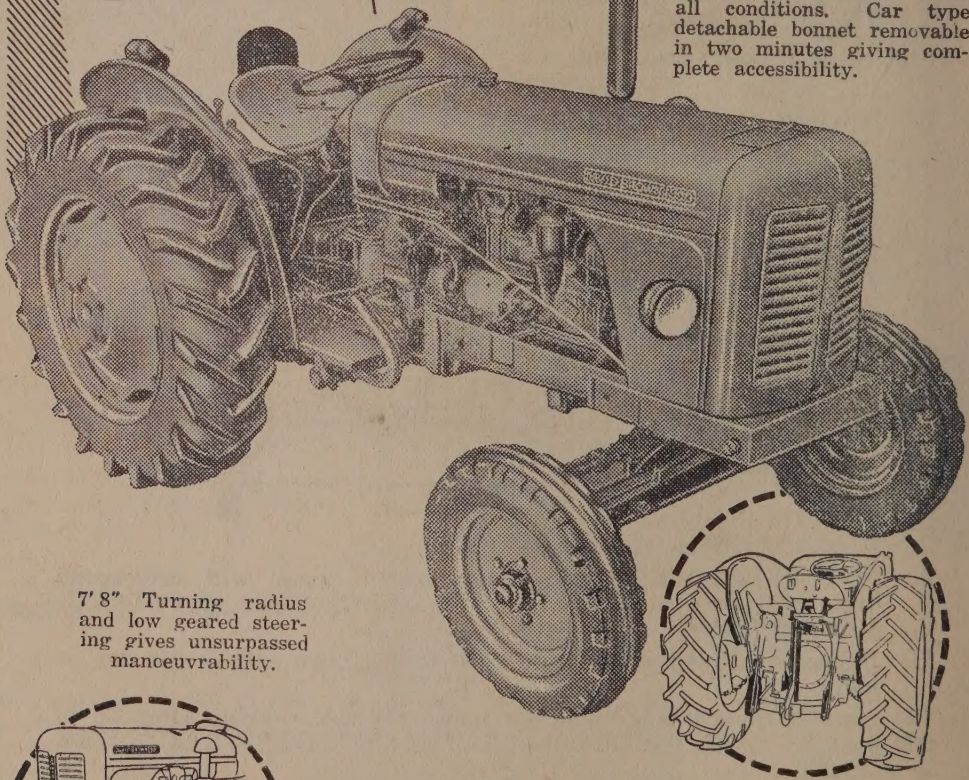
Phone: 37734 Showroom — Phone: 25642 Office & Accounts

DAVID BROWN

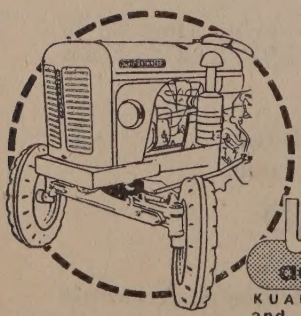
900

New features and proved features

The new powerful David Brown 900 with its 40 H.P. diesel engine and patent traction control unit gives unsurpassed traction under all conditions. Car type detachable bonnet removable in two minutes giving complete accessibility.



7' 8" Turning radius and low geared steering gives unsurpassed manoeuvrability.



Hydraulic lift for heaviest implements, with category one or two linkages.

Wearne's

agricultural and heavy equipment division

KUALA LUMPUR — PENANG — IPOH — SEREMBAN — MALACCA

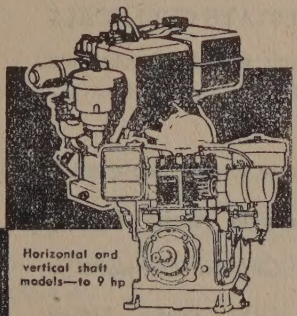
and at FEDERATED MOTORS LIMITED, SINGAPORE

Why it pays to power with

BRIGGS & STRATTON

4 CYCLE, PETROL ENGINES

First, wide choice of models. Second, precision-made. Third, these engines are backed by a reputation built on easy starting, smooth running, low maintenance cost and long trouble-free life.



Horizontal and vertical shaft models—to 9 hp

4 CYCLE
BRIGGS & STRATTON
GASOLINE ENGINES

Engines bearing this trademark are **No. 1** *in use throughout the world*

The following equipment which is sold throughout Singapore, Malaya and Borneo is powered by BRIGGS & STRATTON petrol engines:—

Midland Self-Priming Centrifugal Pumps
Hamco Portable Electric Generators
Jason Portable Electric Generators
Savage Lawn Mowers.

Central Service Distributors:

STOKVIS (M) LTD.

SINGAPORE — KUALA LUMPUR — IPOH — PENANG

for your information

The supply of ESTATE CHEMICALS is a service which we have performed for many years for the planter.

Our wide range covers Alum Crystals, supplied in paper-lined Hessian Bags of 112 lbs.; Barium Carbonate Precipitated in one cwt. bags; DDT Powder, Sodium Sulphite for factory and field uses; Ammonia Solution; Granular Sodium Arsenite for the eradication of Lallang; Paranitrophenol, etc.

These are but few of the lines we stock. Forward us your order or call and discuss your problem with our technical experts.

ESTATE CHEMICALS? SEE JAMES WARREN!

JAMES WARREN

KUALA LUMPUR — SINGAPORE — IPOH

Rat on the run!

Rats may mean serious economic losses to estate produce and represent a health hazard at all times.

'SOREXA' based on the new chemical *Warfarin* is particularly effective against rats and mice since it is tasteless and odourless and gives no warning of death. For methods of use consult the direction sheet entitled "Vermin Control" which should be present in your copy of the "PLANTER'S HANDBOOK".

ICI

FOR AGRICULTURE

NOTHING UP MY SLEEVE

No drips down his shirt either. "The **'Cock's Head' Brand DDT 25% Miscible Liquid** (or is it **'Agrocide' 26 DP?**) is spread evenly over the coffee foliage with this natty little sprayer, just where *Apogonia* and other leaf-eating beetles won't like it.

The **'Lancet'** sprayer is cheap, fool-proof, and easy to use. If he had to deal with those tall palms in the background all that is required is the **Long Lance Kit** fixed to the midrib of a Bertam Palm. So useful too for the application of **'Fylomac' 90** for Pink Disease.

What more suitable sprayer could you wish for to give your orchids and pot plants their once-a-week treatment with **'Cock's Head' Brand Malathion** *(1 fl. oz. to 3½ gal. water).*

'COCK'S HEAD' BRAND PRODUCTS

I. C. I. (MALAYA) LTD.

THE

Malayan Agricultural Journal

Edited by the Publications Officer
with the assistance of the Publications Committee.

Vol. 42, No. 2 **1959**

Page

Editorial 51

ORIGINAL ARTICLES

The Rambutan, A Description of the Characteristics and Potential of the More Important Varieties. *By C. Whitehead, B.Sc. (Hort.), D.T.A.* 53

Commercial Fruit Nurseries in Perak. *By T. R. Dickinson, P.J.K., B.Sc. (Agric.), Dip. Agric. (Cantab), D.T.A.* 76

Phytophthora Palmivora—A Parasite of Orchids in Singapore. *By Aldworth Thompson, B.Sc.* 83

A Description of Existing Practices in the Cultivation of Mandarin Oranges in Telok Anson Area. *By R.J.R. Barrett, B.A. (Hons.) (Cantab), Dip. Agric. (Cantab).* 93

Master Farmers of Malaya, X. Yip Wah. *By T. Sockalingam* 98

Notes on Current Investigations and Extension Work, April to June, 1959 102

STAFF NOTES

Awards, Promotions, Retirements, etc. 110

STATISTICS

Market Prices and Production for Selected Agricultural Products 115

Meteorological Summaries 120

THE MALAYAN AGRICULTURAL JOURNAL

The Journal which is published quarterly, is designed to present — as far as possible in non-technical terms — the results of the agricultural research, investigation and extension work performed by the Department of Agriculture and it draws attention to the results of work of a similar nature in other countries.

The price of the Journal is $2/- per copy or $8/- per annum, post free, in Malaya; it is $8.50 or £1 sterling, post free, outside Malaya.

The Journal and other publications may be obtained from the Department of Agriculture, Kuala Lumpur, Federation of Malaya, or from the office of the High Commissioner for Malaya in the United Kingdom, Malaya House, London, W.1.

COMMITTEES OF THE DEPARTMENT

The Standing Committee on Investigations :

The Deputy Director of Agriculture. **(Chairman).**
The Assistant Director of Agriculture. (Research).
The Assistant Director of Agriculture. (Field).
The Senior Agronomist.
The Agricultural Officer, Headquarters. (Secretary)

The Publications Committee :

The Director of Agriculture, Federation of Malaya. **(Chairman).**
The Deputy Director of Agriculture.
The Assistant Director of Agriculture. (Research).
The Assistant Director of Agriculture. (Field).
The Senior Agronomist.
The Publications Officer. **(Secretary).**

The Examinations Board :

The Deputy Director of Agriculture. **(Chairman).**
The Assistant Director of Agriculture. (Research).
The Assistant Director of Agriculture. (Field).
The Senior Agronomist.
The Principal, College of Agriculture, Malaya.
The Administrative Officer. **(Secretary).**

The Advisory Council, College of Agriculture, Malaya :

The Hon'ble Dato Haji Mohamed Noah bin Omar, D.P.M.J., P.I.S., J.P. (Chairman)
Secretary to the Minister for Agriculture.
The Director of Agriculture, Federation of Malaya.
The Director, Rubber Research Institute of Malaya, Kuala Lumpur.
The Principal, Sultan Idris Training College, Tanjong Malim.
The Principal, College of Agriculture, Malaya.
The Hon'ble Enche Hashim bin Awang, J.P., Tassek Glugor.
The Director, Veterinary Services, Federation of Malaya.
Secretary of the Alumni Association, College of Agriculture, Malaya.
The Hon'ble Mr. Yap Kim Hock, Johore Bahru.
Datok Jaafar bin Mampak, Dato Wangsa, Kuala Trengganu.
Mr. Chan Hin Cheung, Kuala Lumpur.
Enche Jamaludin bin Aji, Seremban.
Enche Ismail bin Yusoff, Kuala Lumpur.
The Representative of the Rubber Producers' Council.
The Registrar and Bursar, College of Agriculture, Serdang. **(Secretary).**

The Efficiency Bar Board :

The Deputy Director of Agriculture. **(Chairman).**
The Hon'ble State Secretary, Perak.
The Hon'ble State Secretary, Negri Sembilan.
The Representative of the Federal Government.
The Administrative Officer. **(Secretary).**

THE

Malayan Agricultural Journal

Vol. 42, No. 2, 1959

EDITORIAL

Although the Malayan Agricultural Journal is primarily the vehicle for publishing results of research and extension work carried out by the staff of the Department of Agriculture, contributions from members of other Departments and organisations closely connected with Malayan agriculture are also welcomed. Articles recently published on a new drainage scheme in Johore and on fishery experiments in Malacca aroused considerable interest and in this issue a senior member of the University of Malaya writes on a disease of orchids.

At first sight the connection of orchids with agriculture may not be apparent, but the experiments carried out by Mr. Thompson to identify a fatal orchid blight which first appeared in Singapore in 1957, showed that the pathogen responsible for the disease closely resembled one that attacked rubber, causing "black stripe" on the tapping panel, and also one causing damage to papaya. Experiment showed that the fungus would readily attack Amelonado cocoa pods and stems, thus posing a threat to the crop under certain climatic conditions. Mr. Thompson describes methods of prevention and control of the disease and the climatic conditions necessary for its propagation.

The remaining articles in this issue are concerned with various aspects of the fruit industry in Malaya.

The Rambutan. The Senior Agronomist, Mr. Whitehead, describes the major botanical features of the rambutan tree and gives details of acreage, distribution and harvesting seasons in Malaya. He also describes eleven of the more important varieties and some of these are named here for the first time. The information on yield, quality, early bearing capacity and profitability of selected varieties is of considerable importance to commercial growers. It must be noted, however, that results based on a study of yields over ten years is not necessarily conclusive, given the conditions under which the trials were carried out.

Comercial Fruit Nurseries in Perak. A timely article on the evolution and organisation of two commercial fruit nurseries is contributed by Mr. Dickinson, State Agricultural Officer, Perak. Up to now the Department has been supplying the clonal budwood from

selected varieties of rambutans, etc.. for propagation by the nurserymen. This has been done in order to keep a close check on the quality of trees produced as a safeguard to the public. The demand for high quality planting material is steadily increasing and Malaya's fruit harvest can be tremendously improved, both in quality and quantity, if the selected clones continue to be honestly propagated and distributed by commercial nurserymen.

Cultivation of Mandarin Oranges in Telok Anson Area. This is a brief description of existing practices in commercial orange production round Telok Anson, Perak. It contains a useful estimate of the cost of bringing one acre of orange land into bearing.

Master Farmer, Yip Wah. An interesting account by Mr. Sockalingam of the profitability of good farming in the Cameron Highlands shows that intensive vegetable cultivation there gives one of the highest returns per acre of any crop in the Federation. It requires, of course, a high input of labour, skill and measures to maintain soil fertility against erosion. As Mr. Sockalingam points out, many farmers in the Highlands neglect the latter because of insecurity of tenure.

THE RAMBUTAN, A DESCRIPTION OF THE CHARACTERISTICS AND POTENTIAL OF THE MORE IMPORTANT VARIETIES

BY

C. WHITEHEAD,

Senior Agronomist.

Introduction

The rambutan (*Nephelium lappaceum*, L) is a member of the family *sapindaceae* and a tree fruit of widespread popularity in the Malay Peninsula. It is cultivated throughout the archipelago and is indigenous to the region.

The rambutan tree is of medium size, from 30 to 50 ft. in height and when grown from seed usually has a straight trunk and a dense head of branches. The leaves are petioled, alternate and pinnate, with two to four pairs of leaflets which are arranged alternately or sub-opposite on the rachis. The leaflets are short stalked and vary considerably in shape from elliptic to obovate, the apex being obtuse or bluntly acuminate. The leaf blade in texture is thinly coriaceous being glabrous above and glaucous beneath. When young, the leaflets are soft, light green and pubescent along the veins. The inflorescences are both axillary and terminal, erect, widely branched, rusty pubescent and bear many greenish pubescent white flowers. The flowers are unisexual, faintly odorous and borne in fascicles along the 'rusty' pubescent branches of the panicles. The calyx is campanulate, five or six cleft and the petals wanting. The cultivated rambutan is usually monoecious, flowers of both sexes being borne on the same inflorescence. Dioecious forms exist however and the occasional tree bearing only male flowers and no fruit is sometimes found.

The fruit is said by Ochse (3) to be a nutlet. It is globose or ovoid in shape and may be various shades of red or yellow in colour. The surface is beset with small tubercles which end in soft, hair like spines of variable length. It is from this hairy appearance that the rambutan derives its name, '*rambut*' in Malay meaning 'hair'. A second nutlet derived from the two lobed ovary is usually found as a small tubercle, at the base of the fruit. The pericarp is a glabrous and the single seed erect and arillate. The aril is white, transparent, sweet and juicy but varies in thickness and quality according to variety. (Plate I).

Acreage and Distribution

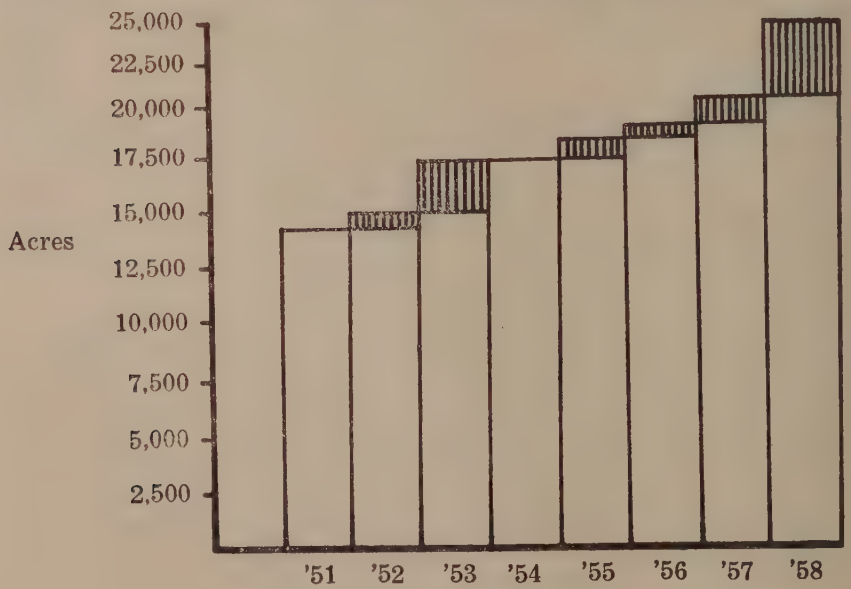
The cultivation of tree fruit crops in Malaya has not yet developed to an extent comparable with that in temperate and subtropical countries. A large number of village orchards consist of a mixture of various fruit species planted out at random. Fruit from these orchards is sold when it is surplus to home requirements but income from such sources is

often looked upon as a windfall and is not considered as a planned feature of the domestic economy. There is however an important and increasing trend towards the cultivation of planned orchards in which one species of fruit is grown as the sole crop. This trend is most marked in the case of citrus but rambutan which together with durian (*Durio zibethinus*, Murr) ranks as the most important home grown tree fruit * is also noticeably affected.

It is estimated that approximately 25 per cent of the rambutan grown in Malaya at the present time is grown as a sole crop This represents a little more than 6,000 acres. In 1958 the total acreage of rambutan was estimated to be 24,000 acres; 67 per cent of this is in mixed kampong cultivation while the balance of eight per cent represents rambutan grown as the main or dominant crop. Distribution of rambutan throughout the Federation is outlined at Map 1 and the progressive increase in total acreage of rambutan over the past seven years is shown at Figure I.

FIG. I

Histogram Showing Total Acreage * of Rambutan from 1951 to 1958.



* Includes sole, main and mixed crop.

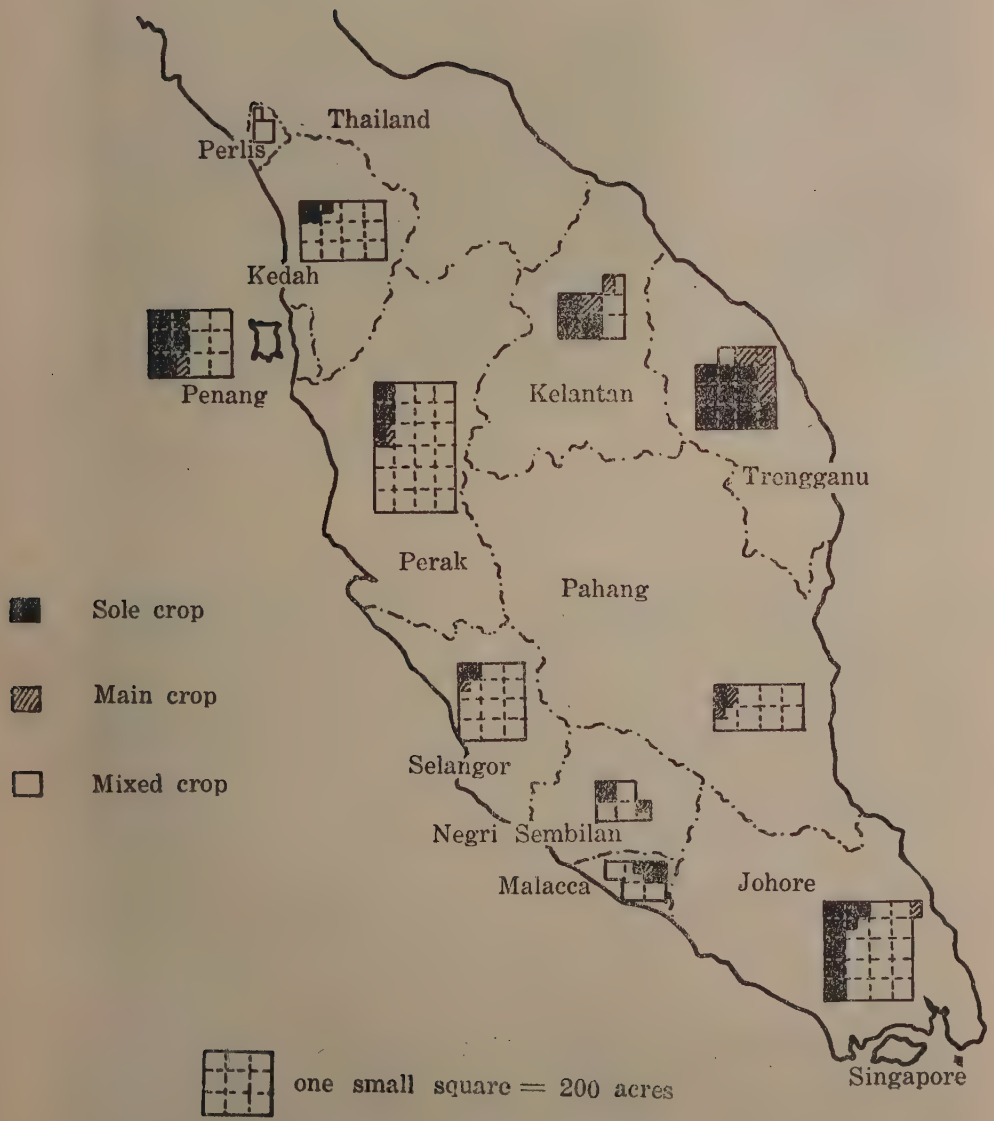
Selection and Propagation

Ochse (3) considers that there are seven distinct forms or varieties of rambutan. Popenoe (5) on the other hand refers to 15 varieties, differing in colour, size and vigour. There is no firm evidence to suggest that either view is necessarily correct and indeed it is accepted that

* Bananas are not considered as a tree crop in this context.

MAP I

Federation of Malaya.



Distribution of Rambutan.

rambutan is usually cross pollinated. Thus under natural conditions there is almost certainly considerable genetic variation.

Seedling progeny are variable in character and in order to preserve and reproduce trees with desirable features it is necessary to resort to vegetative propagation. This has in fact been done on a limited domestic scale for several generations and the value of using varieties propagated vegetatively is generally accepted. Dissemination of this material was limited by poor communications prior to the turn of the century. The use of marcottage as the *modus operandi* for vegetative propagation also restricted the spread of selected material, as rambutan is not an easy subject to propagate in this manner. Budgrafting has proved to be a suitable method of propagation. Shield budgrafting is not feasible but the modified forkert system described intially by Lambourne (2) and also by Feilden (1) has been widely accepted and in recent years budgrafted plants of selected varieties are in great demand.

The selection of varieties and the production of clonal material started in 1932. 144 varieties were selected prior to the war but a number of these were rejected at an early stage. The war and the period of occupation resulted in the loss or admixture of a great many clones and in 1946 only 21 of the prewar selections were traceable. Information on these clones has since been reassembled and with further selection 32 varieties are now on register. The following is a description of eleven of the more important varieties at present in use. Figure II illustrates seed characteristics of these varieties.

Description of Varities

R.1 CHOOI ANG

Selected: Penang, 1932.

Foliage: Large leaves, similar in appearance to R.9 but with a greater number of laterals and in consequence a denser head. The leaves are shiny when young. The lower part of the leaf scar is raised and the axillary bud is set close to the scar. The young flush is lightly tinged pink on the inner side of the leaf rachis.

Fruit: Large, oval, pink/light red colour. Pericarp colour, orange/yellow. Spines pink to scarlet tipped green. It has a thin pericarp, thick aril and small seed. Aril becomes watery when over ripe.

Flavour: Attractive, sweet and faintly acidic. It peels from the seed without adhering testa.

Canning Quality: Unknown.

R.3 PENG TH'NG BEE

Selected: Penang, 1933.

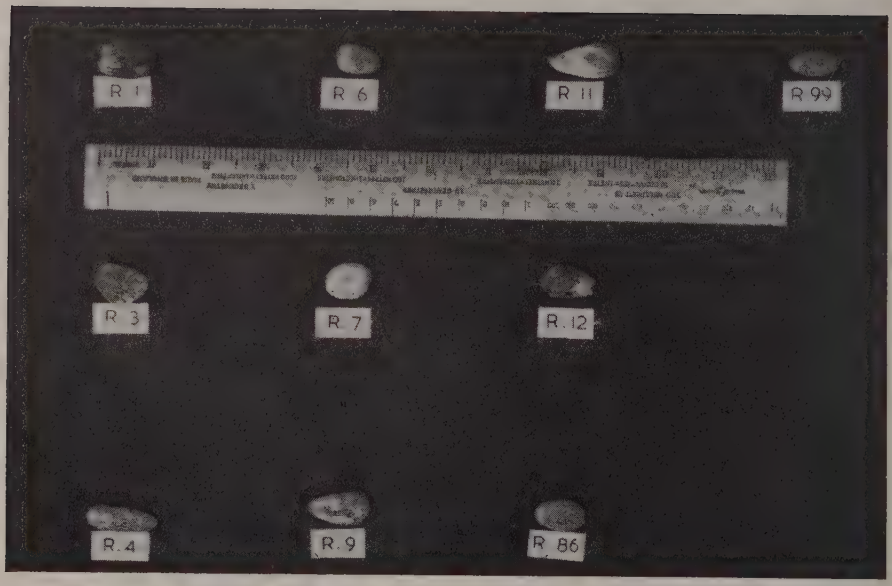
Foliage: Large rounded leaves with obtuse tips and distinctive character. Axillary bud initials stand out noticeably. Leaf scar is very broad. Young flush lightly tinged pink.

PLATE I

Rambutan Tree in Fruit

Rambutan fruit and section

PLATE II



Seed of Rambutan varieties. Note distinctive characteristics.

Fruit: A large to medium, round, crimson coloured fruit. Pericarp crimson with occasional yellow pigmentation. Spines numerous, long, thin and tipped green for two thirds of their length. It has a pericarp of medium thickness, thick aril and fairly large seed.

Flavour: Very desirable sweet flavour, peeling cleanly from the seed without adhering testa.

Canning Quality: Good. Flesh of canned fruit is white in colour and easily removed from the seed. The syrup is clear.

R.4 YA TOW

Selected: Penang, 1933.

Foliage: Growth vigorous. Leaves of average size hard textured with bluntly acuminate tips. Distinctively ribbed in character, the lamina being raised between the veins. The young flush is entirely green in colour. Leaf scars and axillary buds are raised on the stem. The three corners of the leaf scar are raised and the surface of the scar is concave.

Fruit: Large/medium, elongated, oval, scarlet coloured fruit. Pericarp basically scarlet with some yellow pigmentation. Spines numerous, thin, of medium length and green/yellow colour. Fruit stalk is long. The pericarp is thin, the aril thick and the seed is small, markedly elongated and easily broken. The seed may be absent in small fruit.

Flavour: Pleasant and sweet but peels with some of the seed testa adhering.

Canning Quality: Very good. Flesh white in colour and syrup clear.

R.6 AYER MAS

Selected: Penang, 1933.

Foliage: Yellowish in appearance. The leaves are rounded and curled. The young flush is entirely green and twig bark has a greyish tinge. The internodes are short and the tree lacks vigour. The leaf scar is small and flat and sometimes can be seen only with difficulty.

Fruit: Medium/small sized, oval, yellow fruit. Pericarp basically yellow but turning slightly pinkish when ripe. Spines numerous, elongated and yellow/green in colour. Pericarp of medium size. Aril firm, of medium thickness and the seed is small.

Flavour: Pleasant and sweet but not of outstanding quality. It peels with some of the seed testa adhering to the aril.

Canning
Quality: Unsatisfactory.

R.7 KEPALA BESAR

Selected: Penang, 1933.
Foliage: Leaves small, elongated, dark green in colour and dry or hard textured. Young flush is tinged with pink. Bark is smooth and leaf scars are small and flush with the surface.
Fruit: Medium sized, round and crimson in colour. Pericarp crimson, sometimes merging into yellow. Spines red, lightly tipped yellow/green. Pericarp of medium thickness. Aril soft and of average size. Seed large.
Flavour: Pleasant sweet flavour. Peels with a little of the seed testa adhering to the aril.
Canning
Quality: Excellent; flesh of white colour separating easily from the seed. Flavour is particularly good and the syrup is clear.

R.9 TAU POH CHENG

Selected: Penang, 1933.
Foliage: Very large glossy light coloured leaves similar in character to R.1. The leaves are usually turned up at the end and leaflets rarely exceed 4 to 5 in number. Vigorous habit with formation of a minimum of laterals. Flush green with pink spots. Twig bark of light grey colour and branches brittle. Leaf scars small but with a long leg to the characteristic T shape.
Fruit: Large, elongated, oval and scarlet/orange in colour. Pericarp red/orange. Spines very long 'whiskery' and tipped yellow/green in colour. Pericarp thin, aril fairly thick and seed large.
Flavour: Desirable, sweet and faintly acidic. Peels cleanly from the seed without adhering testa.
Canning
Quality: Unsatisfactory.

R.10 AZIMAT

Selected: Selangor, 1933.
Foliage: Small to medium size dark green shiny leaves. Internodes short and petioles distinctively short. Young flush borne on pinkish shoots and the young leaf rachis is tinged pink on the inner side.
Fruit: Large, oval fruit of variable orange/yellow to crimson

colour. Spines yellow in colour. Pericarp fairly thick, aril thick and juicy and seed of average size.

Flavour: Pleasant, sweet and attractive, sometimes acidic flavour. Flesh sometimes rather soft. It peels cleanly from the seed without adhering testa.

Canning Quality: Unsatisfactory.

R.11 BARA

Selected: Selangor, 1933.

Foliage: Narrow pale coloured leaves of average size with distinctive acuminate tips. Leaves of soft texture. Young flush very lightly tinged pink, the pink colour being found on the inner side of the petioles.

Fruit: Large, elongated, oval and crimson in colour. Pericarp crimson but base of fruit is sometimes yellowish. Spines are long and yellow/green at their tips. Fruit stalks are extremely long. Pericarp thick and aril of medium thickness. The seed is of medium size.

Flavour: Juicy, acidic fruit, attractive to the European palate but disliked by Asians. It peels with difficulty, some of the aril adhering to the seed.

Canning Quality: Unsatisfactory.

R.12 KELIP$_2$

Selected: Selangor, 1933.

Foliage: Leaves fairly large, broad and dark green in colour with an oily sheen. Veins on the underside of the young leaf are pink in colour.

Fruit: Average size, crimson in colour with distinctive yellow/green spines. The pericarp is thick, the aril of only medium thickness and the seed large.

Flavour: Pleasant but not outstanding in character. It does not peel particularly well and some of the seed testa comes away attached to the aril.

Canning Quality: Unsatisfactory.

R.86 SINGAPURA

Selected: Singapore, 1939.

Foliage: Leaves large short stalked, flat in character and bluntly acuminate. Young flush tinged with pink and twig bark roughly surfaced. Leaf scar slightly raised on the stem but the surface of the scar is concave.

Fruit: Large, oval; scarlet to pale orange in colour. Spines are long, curved and tipped green/yellow in colour. Percarp is thick, aril somewhat thin, and the seed is large.

Flavour: Pleasant; sweet but not outstanding. It peels with a little of the seed testa adhering to the aril.

Canning Quality: Unsatisfactory.

R.99 TRIANG *

Selected: Pahang, 1939.

Foliage: Leaves large and rounded in shape. Young flush distinctively pink with red petioles.

Fruit: Medium in size, round in shape and dark red in colour. Spines are short and succulent. Fruit is borne in distinctive, densely packed, club like clusters, liable to mealy bug infection. Pericarp is of medium thickness, the aril of fair thickness and the seed small.

Flavour: Sweet and reasonably pleasant but not outstanding in character. Peels with a substantial amount of seed testa adhering to the aril.

Canning Quality: Poor. Texture of flesh woody, separating from the seed with difficulty, the latter breaking when chewed. Flavour of canned fruit is fair.

The Comparative Values of Selected Varieties

Selection of varieties of rambutan both before and since the war has been based very largely on fruit quality. Yield data and other information from prewar planting was lost during the Japanese occupation, hence the need to clarify the relative merits of various varieties, particularly those already used for extension purposes, is of considerable importance. Since the war a large number of rambutan varieties have been included in variety trials. Reliable data is at yet available from only one such trial, FESS.18. This trial has clarified the relative merits of several varieties of rambutan under specific conditions. It has not however indicated whether the varieties are either self or cross compatible and this most important feature remains to be clarified. The more important features of the trial and the results and conclusions which may at the present time be drawn are as follows.

Rambutan Variety Trial

FESS. 18

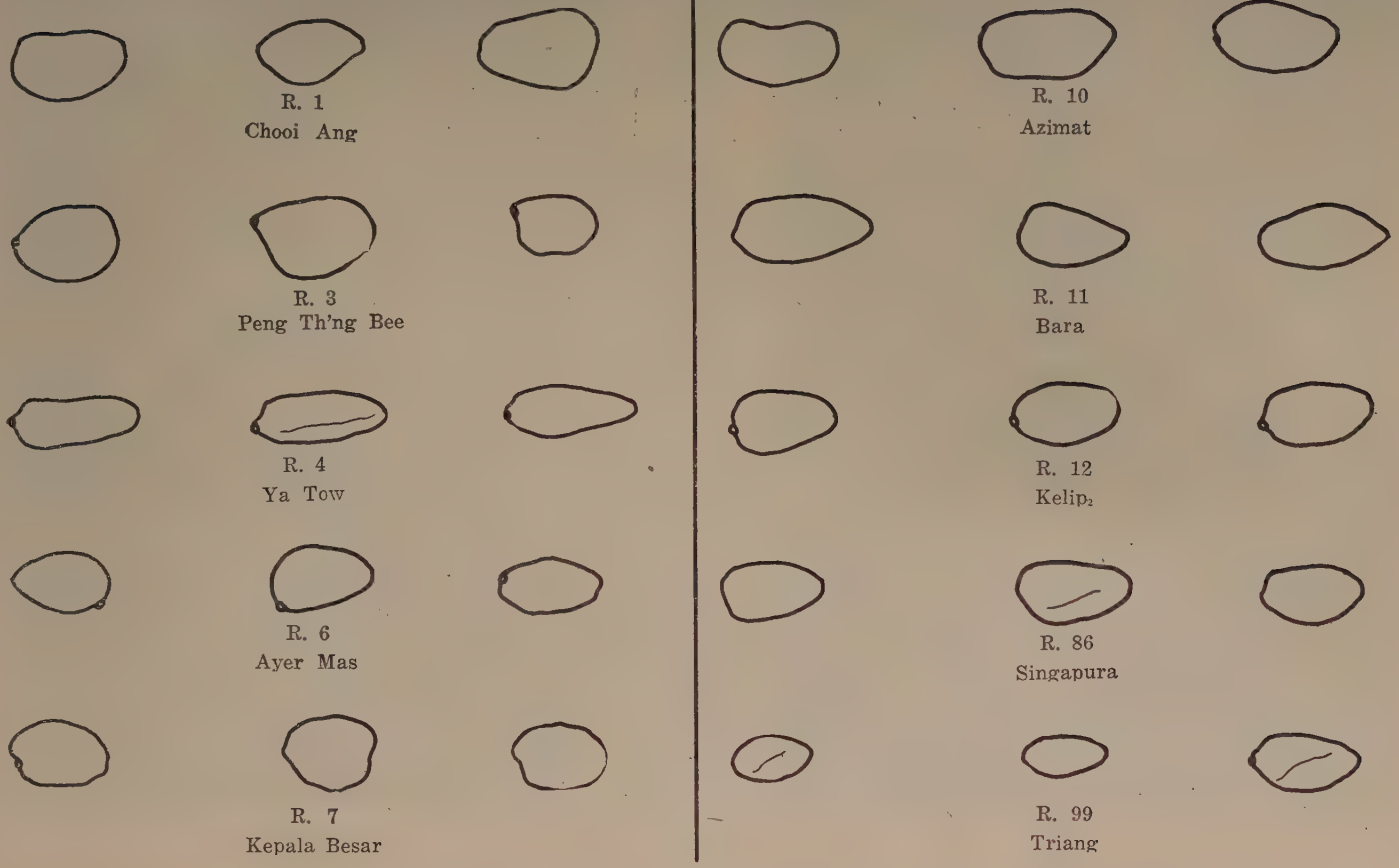
The trial was laid down at the Federal Experiment Station, Serdang, in 1948. It was designed to provide information on the relative fruit quality, flowering and harvesting dates, age at first bearing and the relative profitability of fifteen rambutan varieties. The trial is sited on undulating land on soil of mediocre fertility classified as Serdang sandy loam. This soil is derived from quartzitic or conglomeritic parent

* A yellow sport of this variety was found in 1954 and is registered as R.155.

FIG. II

Outline Diagram of Seed of Ten Varieties of Rambutan.

(Reduced to 2/3 Actual Size)



material and has been described by Panton (4). The fifteen varieties tested are:—

R.1	R.6	R.11	R.68	R.86
R.3	R.7	R.12	R.81	R.99
R.4	R.10	R.61	R.84	R.133

The trial is of randomized block design with three replications. Each block contains 15 plots and each plot consists of four trees of one variety planted in line, 30 feet apart. A square planting design was used and no filler trees were planted. No internal guard rows were provided but a single discard row surrounds the trial which covers a total area of 24,400 square yards. Budgrafted plants were used, budwood of the 15 varieties being worked onto open pollinated seedling rootstocks obtained from a number of undesignated mother trees. The use of seedling rootstocks of variable genetic origin is now thought to be an important source of between tree variation which has seriously affected interpretation of results. It is unfortunate that shortage of staff at the time of propagation and planting resulted in the admixture of planting material of certain varieties. This later necessitated detailed identification of rogue material and has contributed towards the high error variance obtained. The importance of ensuring strict supervision of nursery management in preparation for field trials with fruit trees under conditions prevailing in Malaya has been most clearly demonstrated in this trial.

The trial was planted in November, 1948, using hardened basketted plants with scion growth of between two and three feet tall. The field was grassed down in 1950 and has since been maintained under regularly mown grass sward. The dominant grass species are *Axonopus compressus* and *Axonopus affinis* but some infestation with lalang (*Imperata cylindrica*) has from time to time been experienced. The latter has been kept under control by close mowing at frequent intervals. Little information was at first available on the manurial requirements of rambutan. It became clear, however, that heavy dressings of a complete fertiliser high in nitrogen were necessary. The latter nutrient is subject to rapid leaching under local conditions and in consequence it has been applied in three dressings each year, the first and heaviest immediately after harvest and subsequent pruning, the second after flowering and the third during early fruit development. A routine annual dressing of dolomitic limestone has been provided in recent years both to counteract the effect of fertiliser in reducing pH in a soil which is already very acidic and to provide magnesium which is known to be deficient. Fertiliser was first applied by hand in rings about the tree covering an area relative to root spread. As the trees matured, both fertiliser and limestone were applied mechanically as broadcast applications.

Fruit was borne on some of the trees for the first time in 1950. From that year until 1957 and excepting only 1952, one crop a year has been carried. In 1952 and more recently 1957 and 1958 two crops were carried. A study of weather in relation to single and double crop

PLATE III

Rambutan variety trial—FESS. 18

PLATE IV

Spraying Rambutan trees in FESS. 18

PLATE V

High volume spray application against *Apogonia cribricollis*. Burm.

PLATE VI

Canned Rambutan. Note excellence of condition.

seasons, suggests that flower formation may be influenced by the incidence or otherwise of wet weather prior to and at the time of flower bud differentiation. There is a suggestion that heavy rainfall prior to the time of flower bud differentiation—i.e., approximately three weeks prior to flowering—appears to promote formation of wood buds and thus promotes vegetative growth in preference to flower development. Dry weather at the appropriate time, however, seems in certain circumstances to induce formation of flower buds. As might be expected, bud differentiation also appears to be influenced by the nutritional status of the tree. It therefore seems that while rainfall may be of importance, the size of the preceding crop, tree vigour, pruning and other features of management all play a part in influencing flower bud differentiation and the size of the second or off-season crop.

Identification of rogue trees was completed and checked by 1956. The percentage of rogues among the two varieties R.1 and R.133 was so high that these varieties were excluded from further consideration. The remaining 13 varieties, while they contained a percentage of rogue material, were present in sufficient numbers to permit statistical examination of yield data.

Table I

Yield Data

FESS. 18

Mean Yield of Fruit Per Tree by Weight and Number

Cumulative to February, 1959.

Variety	Block I		Block II		Block III		General Mean		Wt. per 100 Fruit
	lb.	No.	lb.	No.	lb.	No.	lb.	No.	lb.
R.3	320.1	5,020	479.6	6,984	566.9	7,973	456	6,660	6.85
R.4	476.0	6,950	518.0	7,853	528.3	7,647	507	7,480	6.78
R.6	230.1	3,667	378.0	5,559	358.9	6,058	313	4,950	6.32
R.7	731.6	9,814	490.0	6,449	554.3	7,373	592	7,880	7.51
R.10	477.1	7,136	441.1	6,132	461.1	6,395	459	6,500	7.05
R.11	441.1	6,203	568.4	7,808	664.5	9,672	569	8,100	7.02
R.12	456.2	8,352	597.7	9,230	350.7	5,727	468	7,770	6.02
R.61	36.6	494	33.1	438	83.5	1,069	49	630	7.78
R.68	518.1	7,176	180.6	2,910	296.4	4,111	339	4,860	6.98
R.81	306.4	4,701	363.4	5,703	459.2	6.226	376	5,540	6.79
R.84	103.4	1,165	425.8	6,244	—	—	318	4,550	6.99
R.86	554.8	7,820	501.6	7,174	305.8	5,664	496	7,250	6.84
R.99	360.7	5,614	382.0	5,549	197.8	2,680	309	4,520	6.84

Analysis of yield data in terms of both weight and number of fruit proved to be difficult in view of the unequal number of authentic

FIG. III

Mean Annual Yield Per Tree as Number of Fruit.

(*Eight best varieties*)

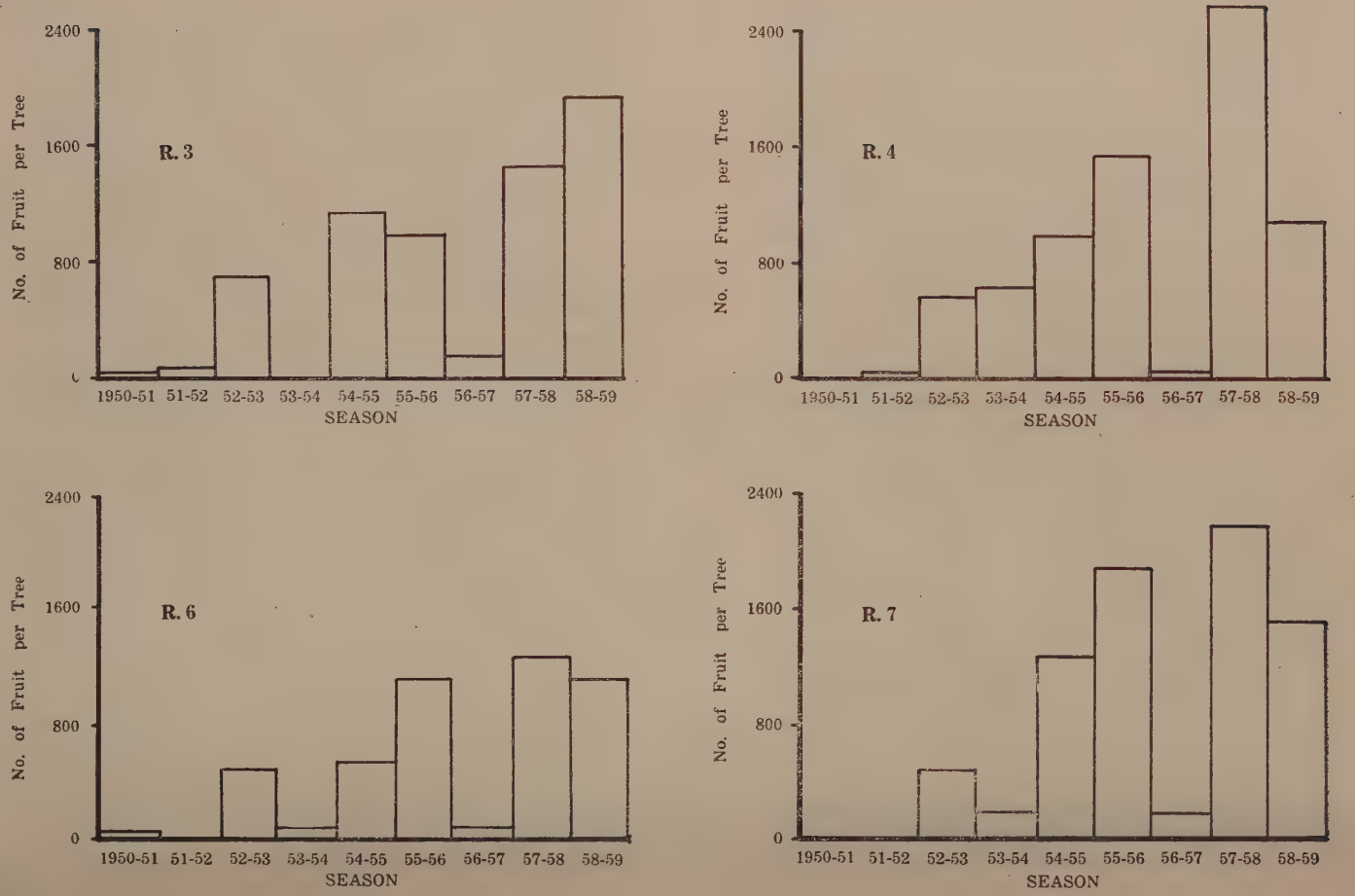
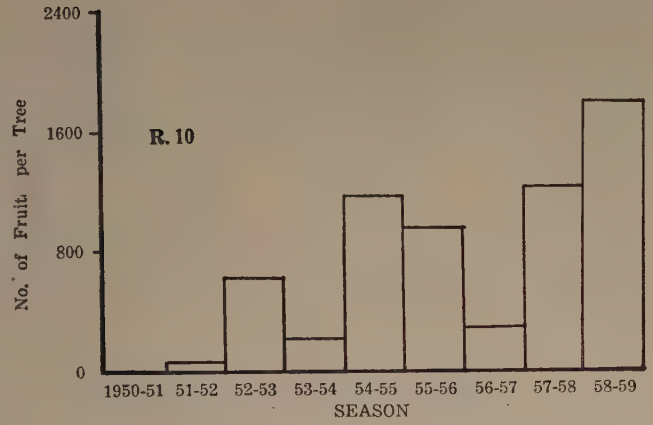
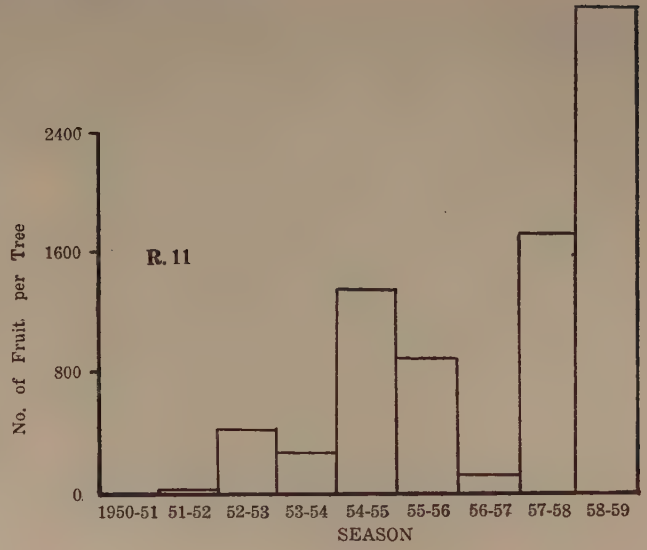
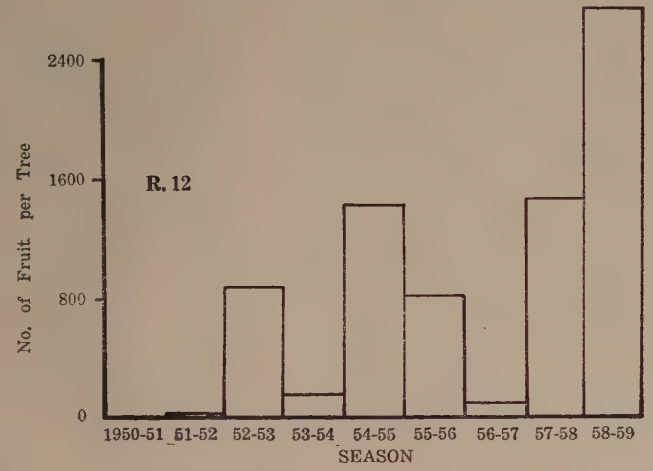
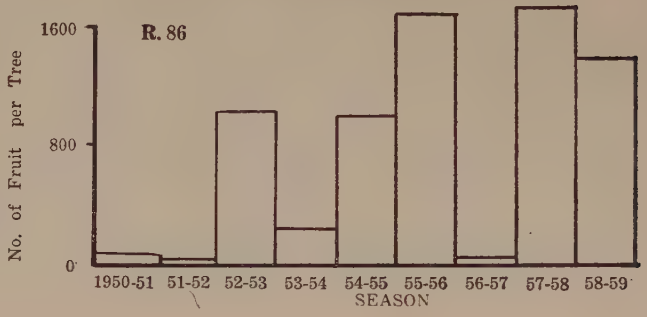


FIG. III.—(*Contd.*)
Mean Annual Yield Per Tree as Number of Fruit.









trees per plot. Unequal errors from plot to plot are to be expected if, as proved to be the case here, the 'between trees within plot' variation forms a major part of the 'between plot' variation. Detailed analyses have shown that variation between plots is no greater than within plots and this has been confirmed by straightforward analysis of yield data from five varieties which are fully represented in all three blocks. In all analyses the blocks show subnormal variation, hence it was decided that in the circumstances block and plot boundaries would be ignored in the final analysis and individual tree data would be used instead. This allows for concentration on variation between individual trees which it has been shown contributes the major part of the variation in the trial.

It will be seen from Table I that the yield from the variety R.61 is abnormally low. This clone was therefore omitted from the final analyses of yield data. The coefficient of variation obtained in the analyses of the remaining twelve clones was 35.4 per cent.

Mean yields of fruit per tree quoted in Table I are based on a varying number of trees for each variety, hence no single error variance can be quoted. Five per cent multiple range tests have been carried out to clarify differences in yield in terms of both number and weight of fruit. These tests are summarized in Table IV and in each case the error per tree is quoted together with the number of trees on which each mean is based.

Table II

5 per cent Multiple Range Test

Differences between any two means are significant when these are NOT underscored by the same line. Any two means underscored by the same line are not significantly different.

A

FESS. 18

Mean Number of Fruit Per Tree

Cumulative to February, 1959

Variety	R.11	R.7	R.12	R.4	R.86	R.3	R.16	R.81	R.6	R.68	R.84	R.99
Yield (Nos.)	8100	7880	7770	7480	7250	6660	6500	5540	4950	4860	4550	4520
No. of Trees	9	12	6	12	6	12	11	6	10	5	6	11

S.E. per tree ± 2281

B

FESS. 18

Mean Yield per Tree in lb. Fresh Fruit

Cumulative to February, 1959

Variety	R.7	R.11	R.4	R.86	R.12	R.10	R.3	R.81	R.68	R.84	R.6	R.99
Yield (lb.)	592	569	507	496	468	458	456	376	339	318	313	309
No. of Trees	12	9	12	6	6	11	12	6	5	6	10	11

S.E. per tree ± 156.8 lb.

The yield data obtained from this trial is the only authentic information available at the present time. Satisfactory supporting evidence from other formal field trials will not be available for some years, hence it is likely that the data now provided and the tentative deductions drawn will be used more widely than would normally be the case. In the circumstances the writer wishes to emphasise that while every effort has been made to ensure authenticity, the results are specific to the peculiar circumstances of the trial and refer only to yield during the ten years from the date of planting.

EARLY BEARING VARIETIES

The commercial grower is interested in obtaining a rapid return from his capital and he is advised by Whitehead (7) to plant filler trees of early bearing varieties. Information on earliness of bearing obtained from the trial FESS.18 is unsubstantiated but nevertheless of some value as a guide in the selection of early bearing varieties. The relative yields obtained in the early years are outlined in Figure IV.

It would appear from this data that R.3, R.12 and R.86 might *tentatively* be considered as varieties suitable for use as filler trees.

FLOWERING DATA

It has been mentioned that rambutan is normally cross pollinated. Information is not available concerning the specific self and cross compatibility of clonal material, nevertheless there is some evidence to suggest that certain clones are self compatible. There is no evidence of cross incompatibility between varieties, but this subject is at present under study.

Examination of flowering records maintained since 1954 for the variety trial FESS.18 has clarified a related factor, namely the relative times of flowering of different varieties. Data is provided in Figure V. It will be seen from this that all the thirteen varieties in FESS.18 overlap in their flowering dates. Certain varieties however appear to be better suited one to another on a basis of their relative flowering dates. Examples of this are R.3, R.6 and R.86 which tend to flower somewhat earlier than a number of the other promising varieties.

FRUIT QUALITY

Information concerning fruit quality, while more easily obtained that that of yield, is less easily defined. That quality is difficult of definition is well known. The most satisfactory assessment is provided by public demand and price offered for the fruit in the open market. Fruit of the 15 varieties included in this trial has been sold to the general public over a period of between 10 and 20 years. It is therefore possible to classify them into three broad quality ratings based on market demand and price.

FIG. IV
FESS. 18
Mean Yield Per Tree 1950/51 Season to 1952/53 Season.

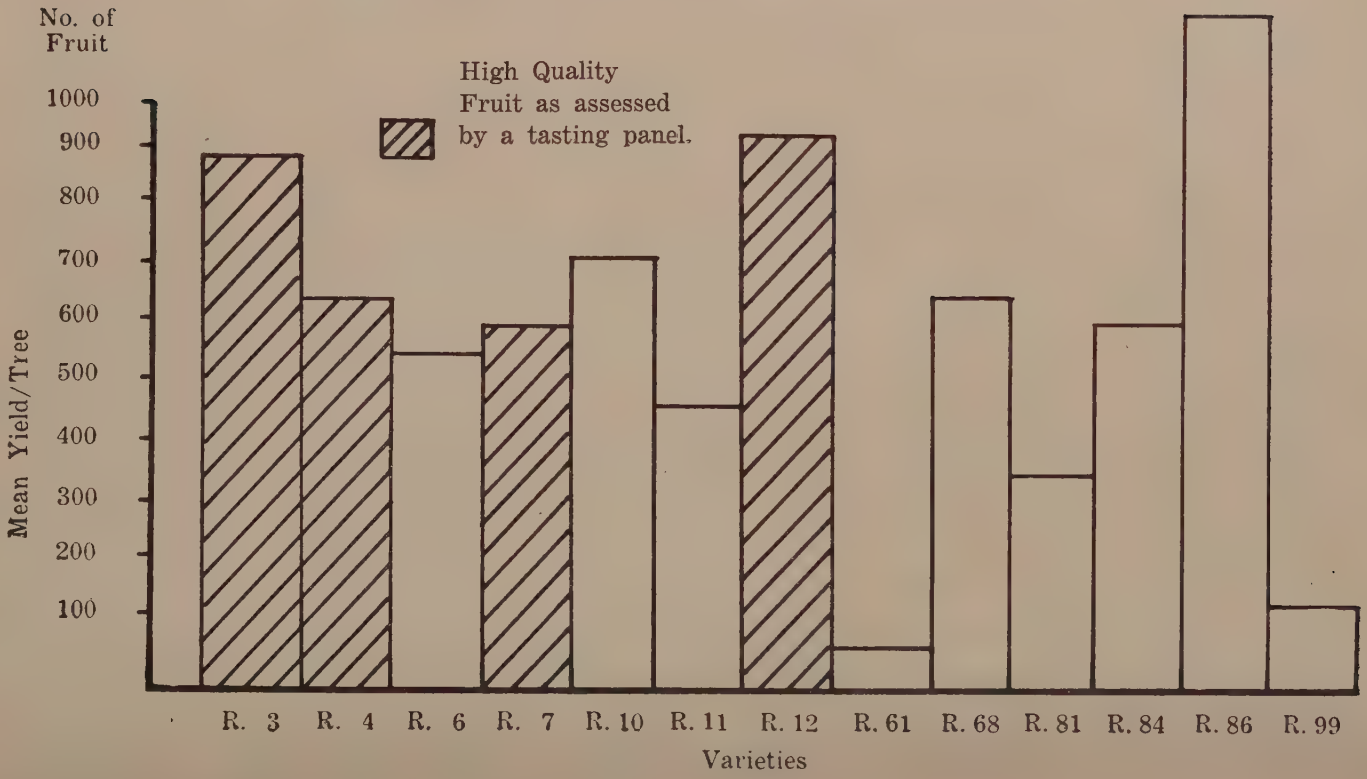


FIG. V

FESS. 18 Rambutan Clonal Trial. Flowering Period (Average 1957 and 1958).

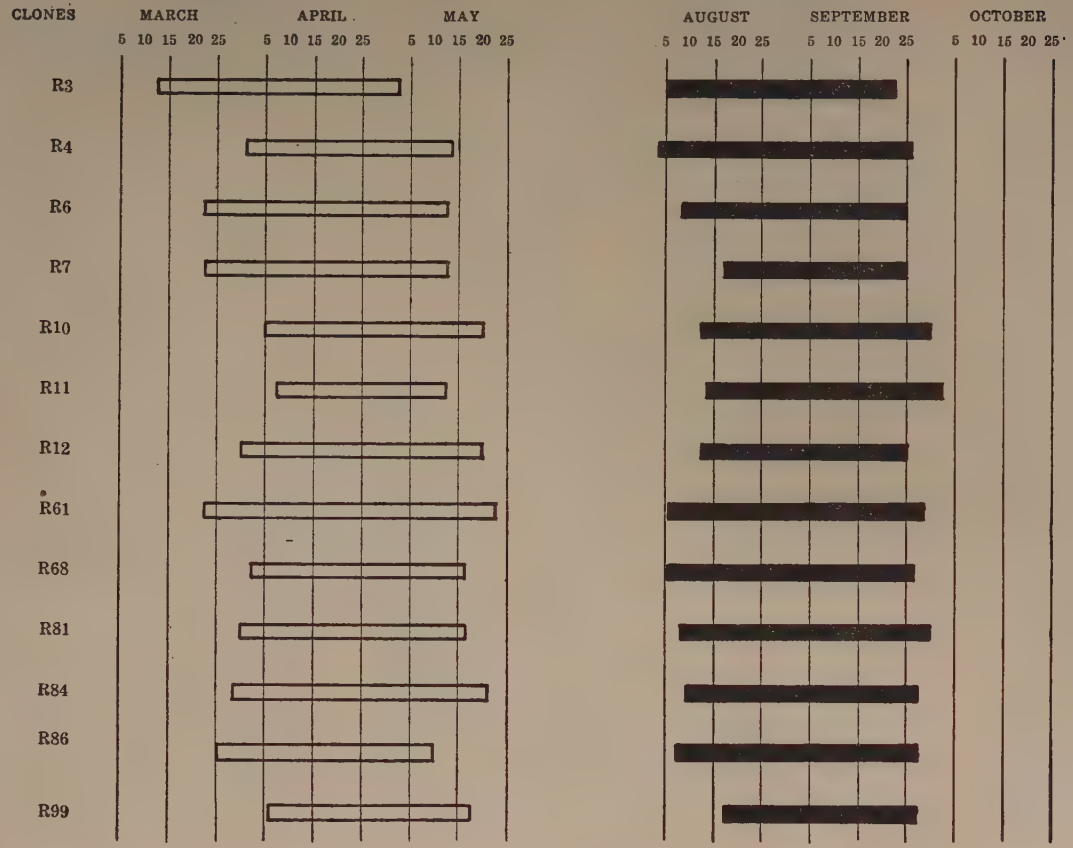


Table III

Quality Assessment

Quality	Varieties
Good	R.3; R.4; R.7; R.12
Fair	R.6; R.10; R.84; R.99; R.86
Poor	R.11*; R.61; R.68; R.81

* Liked only by Europeans

The commercial value of a variety is decided not by either quality or yield alone but by both factors in conjunction. To clarify the relative economic capacities of the thirteen clones tested in FESS.18 it is therefore necessary to adopt an arbitrary valuation of the fruit. This is in the circumstances justifiable but it should be appreciated that the calculated returns do not necessarily reflect the actual financial returns obtainable.

For purposes of calculation average retail prices in Selangor are utilized. Fruit of good quality is valued at $2 per 100; fruit of average quality $1.50 per 100 and poor quality fruit at $1 per 100. Fruit of outstanding quality such as R.3 may in fact be valued higher than this while the least popular varieties such as R.11 may fetch no more than 60 ct. per 100 fruit.

Table IV

FESS. 18

Calculated Mean Returns Per Tree For 13 Varieties Of Rambutan At Retail Prices.

(Over a 10 Year Period from Planting)

In Descending Order of Commercial Value.

Variety	Yield No. of Fruit	Estimate Retail Price per 100 Fruit ($)	Calculated Gross Return ($)
R.7	7,880	2.00	158
R.12	7,770	2.00	155
R.4	7,480	2.00	150
R.3	6,660	2.00	133
R.86	7,250	1.50	109
R.10	6,500	1.50	98
R.11	8,100	1.00	81
R.6	4,950	1.50	74
R.84)	4,550	1.50	68
R.99)	4,520	1.50	68
R.81	5,540	1.00	55
R.68	4,860	1.00	49
R.61	630	1.00	6

CONCLUSIONS

It has been pointed out that the relative commercial merits of varieties are decided by a number of factors but chiefly quality and yield. In the case of the thirteen clones considered in the trial FESS.18 and under the specific conditions prevailing in this trial, the varieties R.7 (Kepala Besar); R.12 (Kelip$_2$); R.4 (Ya Tow); R.3 (Peng Th'ng Bee) and R.86 (Singapura), in that order appear to be the most profitable.

Rambutan Variety Trial

Pk.3.1/48

This trial was laid down at Degong Agricultural Station, Lower Perak, in February, 1948. It was designed to determine the relative yield and vigour of six varieties of rambutan and to provide information on harvesting dates. The trial is established on alluvial clay soil. It is simple in design, consisting of four randomized blocks, each made up of six plots, each plot containing four trees planted in line. Trees are square planted 27 ft. apart, 3 ft. closer than the trees in the trial FESS.18. The six varieties involved are:—

R.1	R.5	R.30
R.4	R.9	R.84

Budgrafted trees were used, scion buds of the six selected varieties being worked onto unselected seedling rootstocks. As in the case of FESS.18 supervision of this operation proved to be inadquate and errors occured which resulted in the planting of a large number of trees which subsequently proved to be rogues. This again emphasises the importance of nursery management when planting trials of this nature. *Gliricidia maculata* was interplanted between the rambutan in order to provide the latter with shade during early life.

The orchard was allowed to grass down but instead of being mown the sward was grazed with cattle at intervals. The trees were circle weeded and mulched in their early years and subsequently manured annually. Lack of staff precluded the possibility of direct supervision of this trial by an agronomist. The trial has in consequence not received the attention it desrved and the standard of management has been considerably inferior to that of FESS.18.

Height and girth measurements were taken in February, 1952, 1953 and 1954. Since 1954 only girth measurements at 1 ft. above ground level have been recorded. The trees first came into bearing in August, 1950, and during the succeeding years the presence of rogues became self evident. These have since been identified but their number and distribution has been such that formal analysis of yield data is not considered to be desirable. Two varieties namely R.1 and R.30 have been entirely ignored. Summarized yield data of the four remaining varieties expressed as mean tree yield is provided at Table V.

Table V

Pk.S.1/48

Mean Yield of Fruit Per Tree By Weight
And Number 1948 To 1958/59 (9 Harvests)

Variety	Mean Yield Per Tree		Weight Per 100 Fruit
	lb.	No. of Fruit	lb.
R.4	250.0	3,037	8.21
R.5	253.6	3,018	8.41
R.9	202.2	2,149	9.4
R.84	154.0	1,582	9.7

It will be see nthat the yield of the varieties R.4 and R.84 in this trial are approximately half of those obtained in FESS.18 although both trials cover much the same period. Fruit weight in the case of both varieties is however greater than that at Serdang. It is not feasible to draw any firm conclusions from this data but it is considered that the difference in results between the two varieties represented in both FESS.18 and Pk.1/48 reflects variation in standards of husbandry and indicates the importance of good husbandry in achieving maximum from the crop.

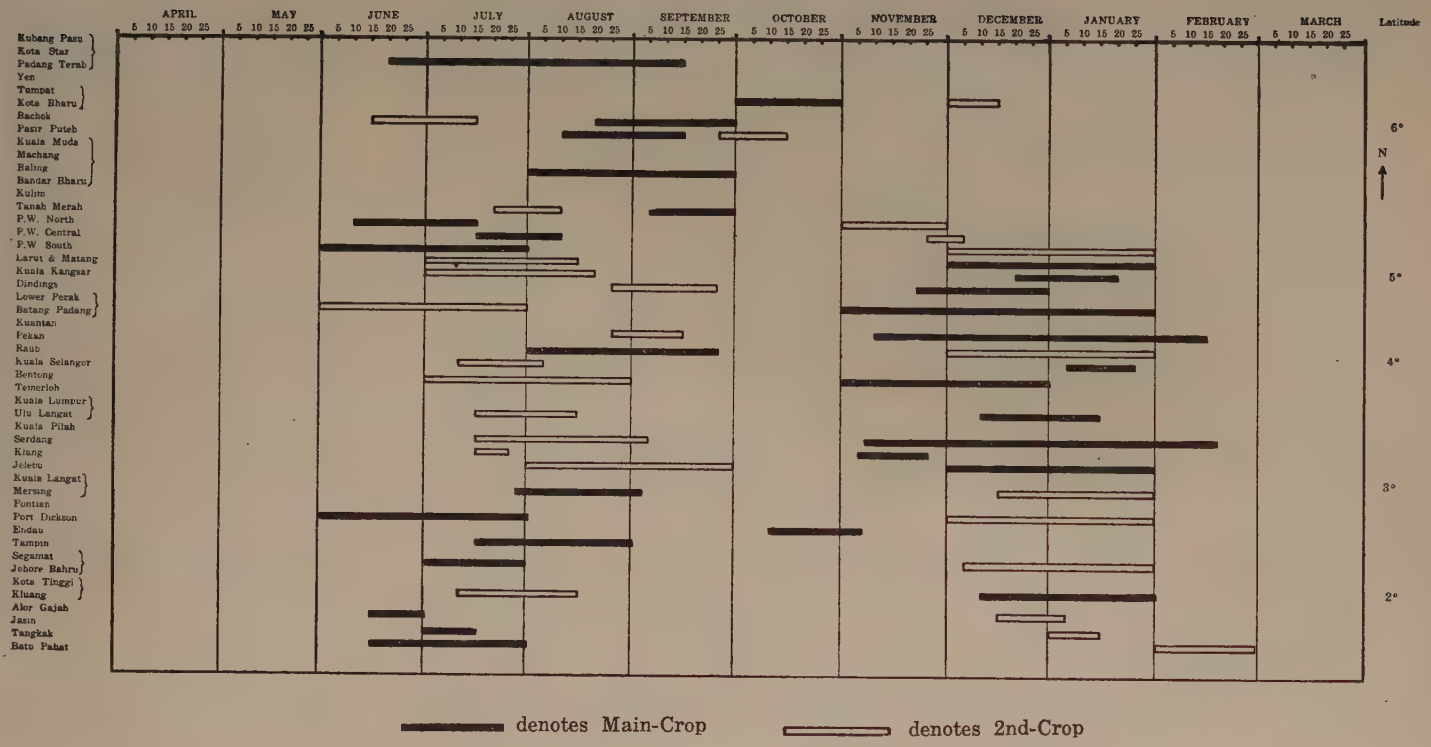
Future Prospects

The rambutan is both a seasonal and perishable crop. In districts not subject to fairly marked dry and wet seasons, two crops a year are not infrequently obtained but one of these crops is usually greater than the other. Variation in the flowering dates of rambutan between one part of Malaya and another does not seem to be necessarily associated with latitude. There is some evidence to suggest that climate, and particularly local climatic variations, influence flowering and therefore harvesting dates. Evidence is inadequate but it is feasible that rainfall distribution and possibly temperature differences may account for variations that do exist. Harvesting seasons for rambutan in various parts of Malaya are outlined in general terms in Figure VI.

It will be seen from examination of this data that while there is considerable variation from district to district the main harvesting seasons throughout the country are between June and September and November and January. There are only a very few areas in which rambutans are harvested outside these periods. It is not uncommon to find that during the harvesting season in one area the market is glutted with fruit for a period. Local gluts however are by no means

FIG. VI

Harvesting Dates of Rambutan.



synchronised and there is in consequence considerable scope for easing gluts by improved distribution. This is often a formidable problem in Malaya as there is neither an organised marketing system nor indeed a very satisfactory laissez-faire arrangement. A great deal of improvement could thus be achieved by market planning and organisation and this would probably encourage an increase in acreage.

Improved distribution of rambutan within peak harvesting periods is only one feature by which acreage and production of rambutan can be increased. There is a long period between harvests during which rambutan is not normally available. If rambutan can either be harvested during this period or preserved, then the acreage under production can be tremendously increased. The data in Figure VI indicates that in a very few areas, e.g. Kota Bharu and Tumpat, the main harvest occurs outside the usual harvesting seasons. Area such as these can perhaps be exploited to considerable advantage, assuming again that improved transport and marketing facilities are available.

The possibility of preserving rambutan for consumption out of the glut seasons for fresh fruit is of not inconsiderable importance. Investigations have shown that a product of acceptable quality can be obtained by canning certain varieties of rambutan. It is probable that consumer demand will initially be restricted to the luxury market, however it is feasible that the price of the canned product may fall in time, particularly if seasonal glutting of the market increases.

It has been suggested that there is scope for development of rambutan production in Malaya. There are undoubtedly many ifs and buts attached to such an argument, but one factor is very clear; if there is to be a successful increase in acreage it is inevitable that selected varieties of rambutan will be almost exclusively utilized. This will be essential if the fruit is to be canned. The highest yielding, best quality and most profitable varieties at present available have been described and it is to be hoped that the information will be of value both to the commercial growers and as a guide to future horticultural research workers.

Summary

The major botanical features of the tree fruit crop rambutan (*Nephelium lappaceum*. L) are described and acreage and distribution in the Federation of Malaya mentioned. The rambutan is variable in character when grown from seed and in consequence selected varieties are propagated vegetatively by budgrafting. Eleven of the more important selected varieties are described in reasonable detail and a ten-year old variety trial designed to indicate the relative values of 15 varieties is outlined. Thirteen varieties are in fact compared and the more promising varieties are tentatively selected on a basis of yield, quality. early bearing capacity and profitability. It is stressed that the conclusions are based only on the yield in the ten year period since planting and refer specifically to the peculiar conditions of the trial.

Another variety trial is briefly described but no firm conclusions are drawn. The prospects for rambutan production are discussed in relation to existing conditions and are considered to be bright. Improved marketing arrangements, development in selected areas and the possibility of canning rambutan fruit are put forward as arguments for using selected varieties.

Acknowledgements

The writer wishes to acknowledge the assistance of those officers who since 1953 have assisted him in the management of the rambutan variety trial FESS.18. Particular thanks are due to 'Che Tahir bin Malim Kaya and Mr. S. Savarimuthu. The writer also acknowledges with gratitude the assistance and time given by the Statistician, Mr. I. Watson, to examination of the results obtained from this trial.

References

(1) Feilden, G.S.C. (1936): "Vegetative Propagation of Tropical and Subtropical Fruits". *Imp. Bur. of Fruit Production* Tech. Comm. No. 7.

(2) Lambourne, J. (1937): "The Rambutan and Its Propagation". *Malay. agric. J.*, **25**, 11.

(3) Ochse, J.J. and Bakhuizen Van Den Brink, R.C. (1931): "Fruits and Fruitculture in the Dutch East Indies". pp. 180, Batavia G Kolff & Co.

(4) Panton, W.P. (1954): "Soil Survey Reports. No. 1, Federal Experiment Station, Serdang. *Malay. agric. J.*, **37**, 136.

(5) Popenoe, W. (1927): "Manual of Tropical and Subtropical Fruits". Pp. 474, New York, Macmillan.

(6) Whitehead, C. (1955): Department of Agriculture, Federation of Malaya, Information Papers Nos. 94 and 106 (Unpublished).

(7) Whitehead, C. (1958): "The Establishment and Maintenance of Fruit Trees". *Malay. agric. J.*, **41**, 163.

COMMERCIAL FRUIT NURSERIES IN PERAK

BY

T. R. DICKINSON

State Agricultural Officer, Perak.

Introduction

The passing of the responsibility for the production of high quality budgrafted fruit trees from the hands of the Department of Agriculture into those of commercial nurserymen is a logical forward step, provided adequate protection is given to the public by the Ministry of Agriculture from the risk of purchasing material falsely represented to be of high quality.

There is an ever increasing demand for budgrafted fruit trees, principally rambutans, as a result of the execution of land development schemes, the replanting of old rubber with fruit trees under the Rubber Replanting Scheme and the replanting of old kampong areas with young trees as part of the extension programme of the Department of Agriculture in the States. In order to increase production rapidly to meet this demand it is desirable for commercial interests to participate in, and eventually to take over, the production of planting material.

In Perak there has been commercial participation in the production of high quality budgrafted fruit trees under Departmental supervision since 1954.

History

In early 1954 Mr. H. J. Simpson, then State Agricultural Officer, Perak, realizing that demand for fruit planting material was outstripping supply, formulated a plan for commercial participation in production. He put his proposals to Mr. Lee Lam Siew of Sungei Buloh New Village, Sungei Siput North and invited him to establish a fruit nursery with the aid and supervision of the Department of Agriculture. Mr. Lee accepted. In early 1955 Inche Ahmad bin Mohd Amin, Agricultural Officer, Perak North at that time, made a similar suggestion to Messrs. Chan Ah Kow and Chan Sek Yew, brothers living at Changkat Jering near Taiping. They too accepted. It was agreed in both cases that the nurseries should be completely under the supervision of the Department of Agriculture, that only budwood supplied by the Department should be used, that a maximum price to be charged for budgrafted fruit trees was $2 per basketted tree, and that the Department had the first offer of trees produced. The Department undertook to advise the nurserymen, to supply free budwood initially, to train their budders and to help where necessary in sale of trees.

Mr. Lee's Nursery

The Site

Mr. Lee has developed approximately two acres of land adjacent to the main road just north of Sungei Siput North. The land is slightly

low lying and the soil is a clay loam of average fertility. At the time of commencement of the nursery the land was under old coconuts and fruit trees and was infested with lalang grass, *Imperata cylindrica*, Beauv.

Development

The nursery was developed in three stages during three successive years by dividing the site into three approximately equal sized blocks for stock seedling beds. In subsequent years each block has been replanted with stock seedlings. There will be no further replanting on this site. Mr. Lee has obtained another site and plans to leave the original site planted up as a rambutan orchard. Production has been confined almost entirely to budgrafted rambutan trees plus a few hundred budgrafted durian trees. Progress in development is shown in Table I.

In 1958 Mr. Lee rented two acres of land from a nearby rubber estate for a period of four years. In September, 1958, he planted 4,000 rambutan stock seedlings and in December, 1958, he planted 20,000 rambutan, 1,500 mango and 500 durian stock seedlings. He plans to plant up the total area with stock seedlings twice before relinquishing the site.

Technique

In May and June, 1954, old coconut and fruit trees in Block 1 of the nursery were felled, uprooted, burnt and cleared. The land was ploughed and twice harrowed. Germination beds were prepared. Approximately 15,000 rambutan seeds and 500 durian seeds were sown. Germinated seeds were transplanted 4 in. apart into raised nursery beds and palm frond shade on bamboo frames was provided. After six weeks, shade was gradually removed and after two months 10,000 vigorous seedlings were transplanted into stock beds. The stock beds were raised to a height of 10 in. They were just over 3 ft. wide at the top and 5½ ft. wide at the base. Cattle manure was incorporated during preparation. Seedlings were planted in four rows 1 ft. apart both in the row and between rows in a triangular arrangement. Palm frond shade was provided until seedlings were about 1 ft. high and was then gradually removed. A top dressing of a complete NPK. fertilizer mixture was given two months after planting at the rate of 6 cwt. per acre. Normal routine weeding was carried out.

During the period March — April, 1955, two budders from the Department of Agriculture budgrafted about 4,000 of the stock seedlings, teaching Mr. Lee the technique. Budwood of rambutan clones R.1, R.4, R.5, R.6, R.7, R.9, R.10, R.30, R.68, R.84, R.86, R.99 and R.133 was used. This budwood was supplied free of charge from Agricultural Station budwood nurseries. Mr. Lee paid freight charges. Since then Mr. Lee and his brother have undertaken all budgrafting with budwood supplied by the Department.

Table I

Development of Mr. Lee's Fruit Nursery.

Block No.	Approx. Size	No. of rambutan seedlings planted	Date planted	Date budgrafted	Total No. of budgrafted plants sold	Period of sale
1	5½ sq. ch.	10,000 approx.	July-Aug. 1954	March-Sept. 1955	6113	Oct. 1955-Sept. 1956
2	7½ sq. ch.	13,000 „	July-Aug. 1955	March-Sept. 1956	9436	Oct. 1956-Aug. 1957
3	5½ sq. ch.	10,000 „	July-Aug. 1956	March-Sept. 1957	5667	Oct. 1957-June 1958
1	5½ sq. ch.	10,000 approx.	July-Aug. 1957	March-Sept. 1958	1500 to date	From Oct. 1958
2	7½ sq. ch.	13,000 „	Jan. 1958	In progress	—	—
3	5½ sq. ch.	10,000 „	July-Aug. 1958	—	—	—

Table II

Development of Messrs. Chan Brothers' Nursery.

Block No.	Approx. Size	No. of rambutan seedlings planted	Date planted	Date budgrafted	Total No. of budgrafted plants sold	Period of sale
1	2½ sq. ch.	8,000 approx.	July 1955	March-Sept. 1956	3316	Oct. 1956-March 1957
2	3½ sq. ch.	10,000 „	Jan. 1956	Oct. 1956-March 1957	4450	April 1957-Mar. 1958
3	4 sq. ch.	12,000 „	Jan. 1957	Oct. 1957-March 1958	6109	April 1958-Dec. 1958
4	4 sq. ch.	13,000 „	Aug. 1957	April 1958-Sept. 1958	845 to date	From Nov. 1958
5	6 sq. ch.	17,000 „	Feb. 1958	In progress	—	—
6	7 sq. ch.	20,000 „	July 1958	—	—	—
1 (part)	1 sq. ch.	4,000 approx.	Dec. 1958	—	—	—

PLATE I

Mr. Lee and an Agricultural Assistant inspect young rambutan stock beds amongst orchard rambutans.

PLATE II

Mr. Lee inspects his growing stock rambutan seedlings.

PLATE III

Preparing the bud patch (Lee's Nursery).

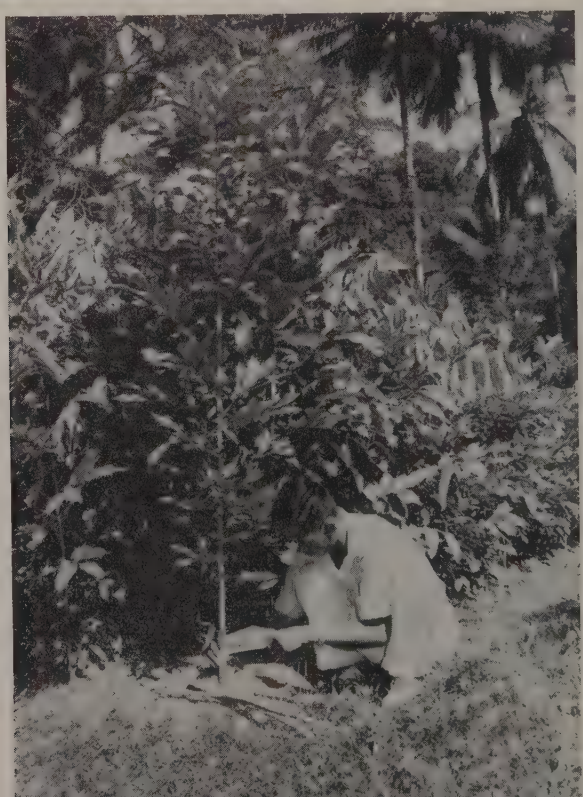


PLATE IV

Mr. Lee budgrafts a rambutan seedling.

An initial problem, not yet fully overcome, was the difficulty of providing sufficient budwood of the correct size for pencil-stem budgrafting to enable basketting of budgrafted plants to be carried out at the time of bud-break. A system of budgrafting larger stock seedlings over a longer period of time, and lifting after the scion had grown to 10 in. or more has been adopted. This practice necessitates the use of large baskets and the removal of large quantities of soil with the plants. Thus Mr. Lee plants any one area of his nursery only twice with stock seedlings to prevent removal of too much top soil.

Blocks 2 and 3 were opened up and developed in a similar manner to Block 1 in 1955 and 1956 respectively. For these blocks the number of rambutan clones supplied by the Department in the form of budwood was reduced by the exclusion of R.5, R.68 and R.99.

Block 1 was not replanted until July, 1957, three years after the initial planting, but subsequently the rate of replanting was increased. Block 2 was replanted in January, 1958, two and a half years after the initial planting and Block 3 was replanted in July, 1958, two years after the initial planting. On future sites Mr. Lee will adopt a two year replanting programme.

In the first year on any one site, Mr. Lee leaves sufficient budgrafted trees for establishment of an orchard for fruit production. The distance between trees remaining is 21 x 21 ft. square planted. Mr. Lee proposes to remove alternate trees when canopies touch, leaving a permanent stand slightly less than 30 x 30 ft. square planted.

A plant house, fertilizer store and tool shed have been erected and portable metal irrigation pipes have been laid throughout the nursery. By means of a small pump Mr. Lee can irrigate any part of the nursery from a well by either trench or overhead irrigation. For overhead irrigation he couples a length of plastic hose fitted with a nozzle to the nearest portable main and operates the spray manually. Four labourers are now employed for establishment and maintenance.

Since 1958 a nominal charge of 10 ct. per yard has been made for budwood, and the clones supplied have been reduced to R.4 and R.7 principally, plus R.1, R.6, R.9 and R.86. It is proposed to make a more realistic charge for budwood when supplies are sufficient for a considerable expansion of Mr. Lee's nurseries. At present he is obliged to under-exploit his resources because of budwood shortage.

Distribution of Budgrafted Plants

The number of basketted rambutan plants sold to date from Mr. Lee's Nursery is given in Table I. Some of the orders received by the Department of Agriculture, including those from the Replanting Board, are passed to Mr. Lee for supply. He also supplies his own customers who usually take delivery themselves of small numbers from the nursery. No supplies are made outside Perak without reference to the State Agricultural Officer who approves such supply only if there are no outstanding orders from within the State. The standard price is $1.75 per basketted plant ex-nursery.

Messrs. Chan Brothers' Nursery

The Site

Messrs. Chan Brothers own 10½ acres of land at Changkat Jering, near Taiping. The soil is a well drained medium loam. At the time of purchase in 1951 the land was under old rubber. Seven acres were replanted with rubber in 1952, one and a half acres were replanted with budgrafted rambutans in 1954 and the balance of two acres were cropped with bananas and food crops.

Development

The nursery was developed in several stages by planting up stock beds on both the area previously under food crops and on the area already planted with young rambutans. Approximately three acres of land have been planted with rambutan stock seedlings plus a few hundred durian stock seedlings since 1955. Replanting has commenced on the first block initially planted in 1955. Progress in development is shown in Table II.

Technique

There were no old trees on the land in 1955. Clearing and cultivating was a simple matter. At the time of clearing the first block, a plant house was erected and germination beds were prepared amongst the 1952 replanted rubber. Messrs. Chan Brothers transplant germinated seeds from germination beds straight into stock beds, without the use of intermediate nursery beds. Stock beds are not raised and shade is not provided. Draught, sunscorch and a high water table are not as troublesome as on Mr. Lee's nursery. There is a much higher volume and more even distribution of rain throughout the year with less sunshine, and the land is high and free draining. Field irrigation is not provided but a pump is used for watering basketted plants in the plant house. Seedlings are spaced 10 in. apart in the row with 12 in. between rows. A bed consists of two rows with 24 in. between beds. A top dressing of a complete NPK. fertiliser mixture is given two to three months after transplanting at the rate of 5 cwt. per acre.

Initially Messrs. Chan Brothers employed two budders. They were trained on the nursery by staff of the Department of Agriculture. A third budder was employed in 1958 and the three budders, together with occasional casual labour, maintain the nursery. Budwood of R.4, R.5, R.9, R.84 and R.99 was supplied free initially. Sources of supply were Agricultural Stations in Perak, Penang and Province Wellesley and Johore. Since 1958 a nominal charge has been made for budwood supplied from Perak Agricultural Stations at the rate of 10 ct. per yard, and principal clones now supplied are R.4, R.7, R.9 and R.84. When availability of budwood is increased a more realistic charge will be made.

The same problem of providing sufficient budwood at the right time exists as at Mr. Lee's Nursery, and Messrs. Chan Brothers at present

PLATE V

Messrs. Chan Brothers

PLATE VI

Messrs. Chan Brothers' stock rambutan seedlings, 1958.

PLATE VII

One of the budgrafters at work (Chan Bros. Nursery)

PLATE VIII

An Agricultural Assistant inspects a consignment of budgrafted durian plants (Chan Bros. Nursery).

follow the same practice of budgrafting stocks over a long period of time and consequently do not lift plants until the scion has developed to 10 in. or more.

Distribution of Budgrafted Plants

The number of basketted rambutan plants sold to date from Messrs. Chan Brothers' Nursery is given in Table II. 150 budgrafted durian plants were also sold in 1957 and 691 in 1958. The brothers fulfil orders passed to them by the Department of Agriculture and also sell privately at the nursery. No supplies are made outside Perak if there are outstanding orders within the State. The standard price is $1.75 per basketted plant ex-nursery.

The Future

Commercial nurserymen as they expand their production will need to produce their own clonal budwood. Since the two Perak commercial nurseries were started, budwood nurseries on Agricultural Stations have been expanded, but administrative difficulties are bound to arise when budwood nurseries and stock beds are under separate management. The rate of expansion of these commercial nurseries has been limited by shortage of budwood. The technique of budgrafting pencil-stem stocks and thereby lifting at bud-break has been impossible because of the difficulty of supplying young budwood in sufficient quantity at the correct time from separately managed Agricultural Station budwood nurseries.

When commercial nurserymen are allowed to produce their own clonal budwood, however, a certain amount of control is lost and it is essential that such budwood should be certified "true to type" as a safeguard to the public. During the period of budwood shortage up to 13 different clones have been supplied to the two commercial nurserymen, but it is advisable for identification purposes that no more than two clones be established by them in their own budwood nurseries.

Both Mr. Lee and Messrs. Chan Brothers are anxious to expand their nurseries rapidly and to have control of budwood production, and their progress to date confirms their suitability for this enterprise. Accordingly, a start has been made by each under Departmental supervision in the establishment of budwood nurseries. The two most highly recommended rambutan clones are R.4 and R.7. Mr. Lee has been supplied to date with 20 budgrafted plants each of R.4 and R.7 from the Federal Experiment Station, Serdang, and has established them as a budwood nursery in two separate blocks on a permanent site. Messrs. Chan Brothers have been supplied to date with 18 marcots and 20 budgrafted plants of R.4 and 13 marcots and 20 budgrafted plants of R.7 from the Federal Experiment Station, Serdang, and have established them on their nursery.

Summary

The need for, establishment, and development to date, of two commercial fruit nurseries in Perak for the production principally of budgrafted rambutan plants is described, together with proposals for their expansion and difficulties encountered in their development.

Acknowledgements

The writer wishes to thank Inche Ahmad bin Mohd. Amin, State Agricultural Officer, Penang, for provision of notes on the early development of Messrs. Chan Brothers Fruit Nursery. Thanks are due to Messrs. Lee Lam Siew, Chan Ah Kow and Chan Sek Yew for provision of details regarding the establishment of their nurseries, and to Messrs. Teoh Ah Nooi and Mooi Soong Wooi of the Department of Agriculture, Perak, for their help in provision of the illustrations.

PHYTOPHTHORA PALMIVORA—A PARASITE OF ORCHIDS IN SINGAPORE

BY

ALDWORTH THOMPSON

Department of Botany, University of Malaya, Singapore.

A blight of orchids was recorded in Singapore in December, 1957, on mature plants of the variety Vanda Tan Chay Yan and on hybrid seedlings which had been raised first in pure culture on agar medium, from a cross between Vanda Tan Chay Yan and Vanda Sanderiana, and grown in pots under shelter out of doors for about a year. A brown rot of the leaves appeared near the junction of leaf sheath and lamina or on parts of the latter more distant from the ensheathed stem. In some cases the rot had extended inwards to the growing point thus killing the plants. *Phytophthora palmivora* was isolated and was shown by inoculation to be the pathogen responsible for the disease. The species is regarded as close to, but not identical with, the Malayan type species of *P. palmivora* in the "rubber" group which is the species most commonly associated with "Black-Stripe" disease of the tapping panel of *Hevea brasiliensis*.

It was observde that the first spores to appear on the rotted orchid tissue were the thick-walled chlamydospores followed later by thin-walled, pyriform conidia; a sequence probably favourable to reproduction of the species under fluctuating environmental conditions. Records of rainfall, relative humidity, temperature and hours of sunshine, in the district where the disease occurred, were studied; and it is suggested that the critical climatic factors which influence the parasitism of the fungus are:—a succession of three days of steady rain, half an inch or more daily, coupled with absence of sunshine, particularly in the morning hours, or with only brief periods of sun totalling less than five hours daily, leading to an excessively moist atmosphere with relative humidity maintained at or above 90 per cent.

Prevention and control measures are recommended.

Introduction

The breeding of orchid hybrids is conducted on a commercial scale by a Chinese horticulturist in Singapore. Seedlings of numerous crosses are grown on agar medium and, when ready, are transferred to small and then to larger pots for growth under shelter until they are large enough to be grown out of doors. On December 24th, 1957, he observed that some mature, outdoor plants of the variety Vanda Tan Chay Yan and many young, seedling hybrids, raised by crossing this variety with Vanda Sanderiana, were diseased. On December 25th specimens were given to me for examination and advice. Surface moulds were absent but, on December 27th, the fungus Phytophthora had appeared on the surface of portions of the leaves which had been placed

in damp chambers and was growing in culture on Quaker oat, Potato-dextrose and Beef-peptone agar media from isolations made from diseased tissue. Bacteria or other organisms did not appear in the cultures which provided pure growths of Phytophthora from the original isolation.

The leaves of Vanda Tan Chay Yan are thicker in the centre with upturned margins and appear U shaped in cross section. They are displayed in one plane and their sheaths closely overlap and enwrap the stem. This type of leaf was also formed by the hybrid seedlings and is efficient in catching water and channelling it via the sheath and stem to the non-aerial roots. After a rain shower, or when the plants are watered, droplets persist in the leaf axils and some sun scorch may occur at this point in plants grown in the open. During wet and cloudy weather the leaf surface remains moist and the presence of drops of water in the axils establishes conditions permitting infection and extension of a pathogen such as Phytophthora.

Symptoms of the Disease

In the seedling hybrids the first indication of disease is seen in the two lowest leaves in which a brown discoloration develops at the junction of sheath and lamina. (Plate I).

The rot extends outwards along the blade and inwards from the sheath to the bud which is killed. The mycelium then invades the tissue of the youngest leaf which becomes brown, but the second or third leaves may not be affected until later. In mature plants the disease may appear as brown lesions scattered over the blade sometimes near the axil (Plate II) and, if the weather continues to be wet and cloudy, the rot may extend into the stem and to the bud so that the plant is killed. An inconspicuous surface mould may appear on the lesions some days after the invaded tissues become brown. When first formed, in the specimens examined, the mould consisted of conidiophores bearing round, thick-walled chlamydospores. Pyriform conidia began to develop soon after the chlamydospores had formed and these germinated within a few hours by means of germ tubes; none of them were observed to produce zoospores and they probably function mainly as conidia and not as sporangia. The chlamydospores are slower to germinate and also function as conidia.

The hyphae in the brown tissue ramify intercellularly and are readily visible in sections stained in lactophenol-cotton blue. When thin transverse sections, cut through brown tissue in an early stage of the disease, were mounted in van Tiegham cells in water numerous chlamydospores were formed within 36 hours on short conidiophores projecting from the epidermal cells. Pyriform conidia on slightly longer conidiophores were formed abundantly some hours later. No sexual spores were observed.

Identification of the Fungus

The writer has maintained in culture, for teaching purposes, three species of Phytophthora; i.e. (i) *P. palmivora* (Butl). isolated from

PLATE I

Orchid seedling hybrid (Vanda Tan Chay Yan x Vanda Sanderiana) affected by *Phytophthora palmivora*.

PLATE II

Leaves of the orchid Vanda Tan Chay Yan attacked by *Phytophthora palmivora* midway between tip and sheath.

PLATE III

Cocoa pod (Amelonado) showing the pericarp rot which develops when the pod is inoculated with *P. palmivora* "rubber" group.

"Black Stripe" disease of *Hevea brasiliensis* in Malaya—a heterothallic species in the "rubber" group established by Gadd (1925); (ii) *P. parasitica*—heterothallic strain—isolated from root and stem rot of *Carica papaya* Linn. not forming oospores; (iii) *P. heveae* (Thompson) isolated by the writer from "Pod Rot" and "Black Stripe" of Hevea in Malaya (Thompson 1929)—a homothallic species which forms amphigynous oospores readily. The species isolated from orchid is morphologically closer to *P. palmivora* than to *P. parasitica* and is distinct from *P. heveae*. In order to compare the orchid fungus with the two former fungi these were inoculated into Hevea and Papaya stems respectively and reisolated in pure culture. The fresh isolates sporulated freely and measurements were made of one hundred conidia and chlamydospores formed by the three species on Quaker oat agar and in water culture in watch glasses containing tap water and a small piece of a cotyledon of a Brassica seedling. Table I summarises the comparative dimensions of the conidia in microns.

Table 1

Comparative Dimensions of Conidia.
(in microns.)

Species and medium	Pyriform conidia. l x w mean	Chlamydospores. diam. mean	Range conidia. l x w	Range chlamydospores diam.	Range ratio l/w Pyriform conidia.	Mean ratio l/w Pyriform conidia.
P. palmivora (Hevea).						
Water	44 x 23	32	24-78 x 15-30	15-36	1.25-2.75	1.91
Q. oat agar	44 x 28	33	27-63 x 18-36	24-39	1.22-2.16	1.56
P. parasitica (Papaya).						
Water	40 x 28	26	27-48 x 18-33	21-45	1.20-1.75	1.46
Q. oat agar	53 x 38	44	45-60 x 33-45	36-51	1.20-1.75	1.40
Phytophthora sp. from Orchid.						
Water	44 x 28	33	24-69 x 15-39	21-39	1.12-2.20	1.56
Q. oat agar	55 x 32	34	30-72 x 24-36	24-42	1.22-2.40	1.72

It would appear from Table I that the species isolated from the orchid disease is not identical with the isolations from rubber and papaya. The papaya fungus is unlike the other two in not forming long, narrow conidia. Its conidia are generally broadly ovate with a prominent papillum; the chlamydospores formed on Quaker oat agar are consistenly larger while those formed in water culture are consistently smaller. The orchid and rubber species are alike in forming numerous elongate conidia in addition to more broadly ovate types and the chlamydospores are approximately equal in size on the oat and water media.

Growth in Culture

In pure culture on Quaker oat, French Bean and Potato-dextrose agars the three fungi form similar aerial mycelium which is more abundant on the oat agar. Pyriform conidia and chlamydospores appear

within 48 to 60 hours on this medium but mycelium and spore forms develop more slowly on the other media. The three fungi were grown separately and in mixed culture on these media and on other agar media adjusted to pH 5.0—pH 7.0. The plates were incubated at room temperature (74°F—85°F) for seven days in order to establish growth, after which period some plates were incubated at 45°F—50°F for short and long periods. The cultures were examined weekly during two months but oospores did not develop in the mixed cultures. Mycelium and spores were scanty on Yeastrel, Malt extract and prune agars and on Glucose/Asparagine agar with minerals, thiamin and biotin added. On these media some differences in type and rate of growth were evident and will be studied more critically at a later date.

Inoculation Experiments

One hybrid orchid seedling (Vanda Tan Chay Yan x V. Sanderiana) was placed in a damp chamber (r.h. about 97%) and conidia of the orchid fungus were placed in a drop of tap water lying in the axil of the lowest leaf. Typical symptoms of the disease appeared within six days with copious production of chlamydospores followed by pyriform conidia on the leaf surface. Another similar seedling was inoculated in this manner but was kept in a drier atmosphere (r.h. about 84%); this seedling remained healthy for two weeks and was reinoculated by wounding the epidermis slightly near the axil and placing a small piece of inoculum in a drop of water on the wound which was kept moist for two days. The brown rot then appeared and the plant was placed out of doors where, during sunny weather, it received morning and afternoon sunshine. The fungus penetrated into the growing point and the seedling died, but conidia were not formed on the surface. Presumably the mycelium can extend in the turgid leaf tissue despite the drier external environment. The absence of conidia suggests that an outbreak of the disease will subside when weather conditions become less favourable to the fungus.

Further wound inoculations were made on the orchid *Vanda joaquim*, Hevea stems, papaya stems, Cocoa pods (Amelonado). The fungi employed were *P. palmivora* (from Hevea); *P. parasitica* (from *Carica papaya*); *P. heveae* (from Hevea) and the species isolated from the orchid disease. The terete leaf of the orchid variety was pricked near the axil; the bark of the Hevea stem was cut longitudinally and transversely and remained undisturbed until the latex had coagulated (six hours). The piece of bark was then removed and the inoculum was placed on the cambium adjacent to the xylem, and the bark was replaced and covered with moist cotton wool and plastic tape. The cocoa pods were surface sterilised in mercuric chloride and sterile water and were kept in sterilised glass basins. The papaya stems were wounded at soil level and the wound was kept moist with cotton wool. The results are shown in Table 2.

Table 2

Fungus	Host	Result	Remarks.
Species from Orchid.	Orchid (leaf) *	+ ve	unwounded. r.h. 97% plant killed.
" " "	" "	— ve	unwounded. r.h. 84%.
" " "	" "	+ ve	wounded r.h. 78%—90% plant killed.
" " "	" " †	+ ve	wounded and kept moist, extensive rot.
" " "	Cocoa (pod) ‡	+ ve	wounded; kept at r.h. 97% extensive rot.
" " "	Cocoa (stem) ‡	+ ve	wounded and kept moist. wood penetrated.
" " "	Papaya (stem).	— ve	wounded and kept moist.
" " "	Hevea (stem).	+ ve	wounded and kept moist.
P. palmivora. (Hevea).	Orchid (leaf) †	+ ve	wounded and kept moist. slight rot in 6 days.
" "	Cocoa (pod) ‡	+ ve	wounded; kept at r.h. 97% extensive rot.
" "	Cocoa (stem) ‡	+ ve	wounded and kept moist. wood penetrated.
" "	Papaya (stem).	— ve	wounded and kept moist.
" "	Hevea (stem).	+ ve	wounded and kept moist. wood penetrated.
P. parasitica (Papaya).	Orchid (leaf) †	+ ve	wounded and kept moist. moderate rot in 6 days.
" "	Cocoa (pod) ‡	+ ve	wounded; kept at r.h. 97%. slight rot. ¼ in.
" "	Cocoa (stem) ‡	+ ve	wounded and kept moist. wood penetrated.
" "	Papaya (stem).	+ ve	wounded and kept moist. extensive rot; fatal.
" "	Hevea (stem).	+ ve	wounded and kept moist.
P. heveae. (Hevea).	Orchid (leaf) †	+ ve	wounded and kept moist. slight rot.
" "	Cocoa (pod) ‡	— ve	wounded and kept at r.h. 97%.
" "	Cocoa (stem) ‡	+ ve	wounded and kept moist. wood penetrated.
" "	Papaya (stem).	+ ve	wounded and kept moist.
" "	Hevea (stem).	+ ve	wounded and kept moist. wood penetrated.

* = hybrid seedling (Vanda Tan Chay Yan x V. Sanderiana).
† = Orchid Vanda joaquim.
‡ = Variety Amelonado.
The inoculations of Hevea were in the stems of one year old plants of *Hevea brasiliensis.*
The inoculations of Papaya were in the stems of six month old plants of *Carica papaya* var *elongata.*
No decay developed in any of the controls.

Discussion of Inoculation Results.

Owing to shortage of Vanda Tan Chay Yan plants and its hybrids, *Vanda joaquim* plants were used in the comparative tests of the parasitism on orchid of the four species of Phytophthora listed above. The species isolated from the orchid disease was more virulent on the orchid than the others in that the mycelium penetrated into the stem, via the leaf sheath, so that a section of stem three inches long was completely invaded and discoloured in four days. *P. parasitica* extended rapidly down the sheath, which became dark brown in colour, but after six days had not penetrated into the stem. *P. palmivora* from Hevea and *P. heveae*

extended only slightly into the mesophyll in six days forming a patch of brown decay one quarter inch long and one tenth of an inch deep.

P. palmivora from Hevea and the orchid fungus readily attacked the pericarp of Amelonado cocoa pods which were lightly scratched near the pointed end, after surface sterilisation with mercuric chloride and sterile water, and inoculated by placing conidia in a drop of sterile water on the wound. The pods were kept in sterile, covered, glass basins containing a little sterile water. Plate III shows the type of rot which developed after nine days. *P. heveae* under similar conditions did not affect the inoculated pod. *P. parasitica* extended slightly into the epicarp in nine days.

The four fungi invaded the stem tissue of cocoa to an equal extent when stems of one year old plants of Amelonado cocoa were lightly scraped to expose the cortex and were inoculated by placing a small portion of a culture on oat agar on the wound. Moist cotton wool covered with plastic tape was placed over the inoculum. A patch of decay three-quarters of an inch long in the cortex and cambium and one eighth of an inch deep in the zylem formed in six days. The fungi were reisolated from the inner margin of the decay in the wood. A similar result was obtained in comparable inoculations of the stem of *Heveae brasiliensis*. When inoculating Hevea in this manner it is advisable to await coagulation of the latex which flows from the wounded bark before making the inoculation, otherwise a film of rubber may cover the wood. The latex begins to coagulate sufficiently within three to six hours.

P. parasitica from *Carica papaya* L. rapidly penetrated into the stem of a papaya plant, six months old, when the stem was lightly scraped at soil level and inoculated. The base of the stem decayed within six days and the fungus extended up the stem in the xylem and pith to a distance of six inches. *P. parasitica* was reisolated from the reddish brown margin of the decay in the pith. The other species failed to attack this host.

Former Records of Phytophthora on Orchid

Gadd (1924) recorded *P. faberi* (Maubl) (syn. *P. palmivora*), on Dendrobium in Ceylon. The sporangia (conidia) on maize agar measured from 49.5—51.6 x 26.5—28.7 microns, with a ratio of length of 1.82—1.86. The chlamydospores on this medium measured 35 microns in diameter. Oospores, 23.5 u in diameter, formed only when the strain was grown in mixed culture with the strain from cacao and it was therefore regarded as belonging to the "rubber" group. The dimensions of the conidia and chlamydospores are reasonably close to those determined by the writer for the Malayan strain on the Vanda varieties.

Schwarz (1927), recorded *P. omnivora* De By. on *Vanda coerulea* (very susceptible), *Cattleya* sp., *Phalaenopsis amabalis* and *Gramatophyllum scriptum* in Java. The conidia of the strain from Gramatophyllum grown on oat agar, were small (33 x 25.4 u); those from Cattleya were large (58 x 35 u).

Ashby (1929), examined the isolations made by Gadd from Dendrobium and by Schwarz from Vanda and Cattleya and grew the strains in mixed culture with the "rubber" and "cacao" strains of *P. palmivora* (Butl) to which species he referred all the orchid isolations. The Dendrobium strain was placed in the "rubber" group; those from Vanda and Cattleya in the "cacao" group.

Secondary leaf-fall (Phytophthora) of Hevea, bud rot of coconut and pod rot of cocoa are diseases not yet recorded in Malaya, and, as recorded in other tropical countries, appear to be caused by the "cacao" strain of *P. palmivora*—a strain not yet isolated from a plant disease in Malaya. The fungus now isolated from the orchid disease, while not identical with the Malayan type species of *P. palmivora* "rubber" group, is closer in morphological and physiological characters to this species than to the strain of *P. parasitica* isolated from papaya and is provisionally identified as *P. palmivora* (Butl.) in the "rubber" group.

In connection with the establishment of a cocoa industry in Malaya the writer was responsible for the introduction of disease-free planting material in Amelonado and other varieties of cocoa from West Africa and the American tropics (Thompson 1950). This material was imported under strict quarantine in December, 1949, and during 1950/51. Special precautions were taken to exclude insects, viruses, the cacao strain of *P. palmivora* and the "mealy pod" fungus Trachysphaeria. Up to now the large number of trees established from the original introductions appear to be free from exotic insect pests and from Phytophthora pod-rot and the mealy pod fungus. The inoculation experiments described above indicate, however, that the indigenous strains of *P. palmivora* "rubber" group are potential parasites of cacao capable of causing pod-rot under climatic and other conditions which await further local investigation.

Climatic Factors Associated with the Blight of Orchids

Species of Phytophthora may survive but do not reproduce effectively in a dry environment. *P. palmivora* can reproduce in a moist, non-liquid, environment by means of the asexual chlamydospores and pyriform conidia. The main factors which influence the incidence of a plant disease caused by Phytophthora are moisture, temperature and sunshine. In the tropical lowlands of Malaya temperature variations during the daytime and in the night are respectively slight, e.g. the mean maximum, even in cloudy daylight or wet weather, is generally about 85°F. dropping to about 73°F at night and rarely being below 70°F. Hence temperature is not as important a factor as in temperate climates.

By courtesy of the Malayan Meteorological Service, Singapore, records were obtained of rainfall, temperature, sunshine and relative humidity in the Kallang and Paya Lebar Districts of Singapore covering the area where the orchid disease occurred. Some of these records are shown in Table III in which climatic conditions in December 1955, 1956, 1957 are compared. In December, 1957, the weather was excessively wet

and there was little sunshine during the period Dec. 15th—22nd. This period is regarded as the critical period when infection of the orchids by *P. palmivora* commenced and extended. It is suggested that the critical factors which influence the parasitism of *P. palmivora* on Vanda Tan Chay Yan are a succession of about three days of steady rain, half an inch or more daily, coupled with absence of sunshine due to cloudy skies, *particularly in the morning hours,* or with only brief periods of sun totalling less than five hours daily, leading to an excessively moist atmosphere with relative humidity maintained at or above 90 per cent.

Table 3

Meteorological Records Taken in the Area where the Orchid Disease Occurred.

	Dec. 1955	Dec. 1956	Dec. 1957
Rainfall in inches			
Total	11.09	10.00	16.35
Daily Dec. 15-22.			
15	0.73	0.76	1.02 *
16	1.57	0.46	0.64 *
17	0.64	0.03	0.44
18	0.05	0.34	0.00
19	0.66	0.00	0.55 *
20	0.00	0.83	0.18
21	0.30	0.08	1.03 *
22	0.00	0.42	1.92 *
Total	3.95	2.92	5.78 *
Mean Daily	0.49	0.37	0.72 *
Temperature °F.			
Daily Max. Mean.	84.8	85.2	84.5
Daily Min. Mean.	72.9	72.8	73.9
Range Dec. 15-22.			G
	Max. 81.3-86.5	Max. 78.0-89.0	Max. 78.5-87.5
	Min. 70.6-74.4	Min. 71.9-74.6	Min. 72.5-74.8
Hours of Sunshine			
Daily Dec. 15-22.			
15	1.25 *	4.60 *	3.80 *
16	6.45	5.75	0.15 *
17	3.55 *	7.20	0.00 *
18	0.00 *	8.75	2.45 *
19	2.35 *	6.95	5.65
20	4.35 *	1.85 *	1.45 *
21	7.15	0.05 *	0.30 *
22	7.60	5.65	0.00 *
Total	32.70	40.80	13.80
Mean.	4.08	5.10	1.72 *
Total December	166.15	146.35	90.85
Mean December	5.36	4.72	2.92 *

Relative Humidity. Mean %	....	86.3	86.1	90.8 *
Range	....	75—95	77—94	83—97 *
Daily Dec. 15-25.				
15	....	91.4 *	87.2	82.4 *
16	....	87.3	85.2	95.7 *
17	....	91.2 *	85.3	96.2 *
18	....	89.8	82.3	88.0
19	....	90.5 *	84.7	91.1 *
20	....	89.6	92.1 *	91.3 *
21	....	86.2	93.6 *	94.3 *
22	....	82.3	91.0 *	97.3 *
23	....	79.2	90.4 *	88.9
24	....	76.7	86.0	90.6 *
25	....	75.2	94.6 *	86.2
Mean. %	....	85.4	88.4	92.0 *

* records probably of significance in determining the climatic conditions associated with the onset and progress of the disease.

The Malayan climate is humid and often unpredictable, but, even in the normal wetter months from October to January and March to May, sunny mornings are frequent and steady rainfall and excessively high humidity with persistent cloud are conditions not normally maintained for lengthy periods such as occur in neighbouring countries more affected by the S.W. and N.E. monsoons. As mentioned above the rubber tree (*Hevea brasiliensis*) in Malaya does not suffer from Secondary Leaf Fall (Phytophthora); "Black Stripe" and "Patch Canker" are not common and "Bud Rot" of the coconut palm due to *P. palmivora* (cacao group) has not been recorded in Malaya where the lowland climate does not favour serious outbreaks of diseases, due to Phytophthora, on the above ground organs of plants. *P. infestans* is of economic importance on foliage of potato (*Solanum tuberosum*) and fruits of tomato grown commercially on the Malayan highlands at elevations above 3000 feet (Thompson 1935), but does not affect plants grown on the plains. The most important damage caused by *Phytophthora spp.* on lowland plants other than Hevea is due to strains resembling the species isolated from *Carica papaya* which is at present classified as a heterothallic strain of *P. parasitica*. This fungus appears to function mainly as a soil parasite attacking roots and stems at soil level, whereas *P. palmivora* appears to function mainly above ground. *P. parasitica* has been recorded by the writer (Thompson and Johnston 1953) in Malaya on roots of papaya, Crossandra, Roselle fibre (*Hibiscus sabdariffa var altissima*), Salvia and pepper (*Piper nigrum*), but is only virulent on plants growing in poorly drained or poorly aerated soils.

The observation, mentioned above, that the orchid strain of *P. palmivora* under natural conditions, first produces thick-walled chlamydospores on the host organ followed by thin-walled pyriform conidia,

capable of direct germination in a moist atmosphere, suggests that the species has adopted an asexual reproduction sequence favourable to its survival in an environment subject to atmospheric moisture fluctuations.

Prevention and Control of the Blight of Orchids

P. palmivora is likely to attack orchids only in periods of steady rain and abnormally high humidity resulting from prolonged absence of sunshine in persistent cloudy weather. During such periods the moving of pot plants to where they will be sheltered from rain, and removal, by means of blotting paper, of drops of water from the leaf axils of semi-terete leaves are measures which will help to prevent infection. The blotting paper treatment is carried out as a routine practice in the orchid breeding enclosure of the Botanic Gardens, Singapore, after the plants are watered or in rainy or showery weather mainly to prevent sun-scorch. The plants are also sprayed with copper fungicides such as Perenox and with insecticides about once a week throughout the year. The pot plants and those growing in beds out of doors have never been attacked by the blight probably because of the routine actions taken. Perhaps the use of strips of blotting paper impregnated with a fungicide would be helpful.

If the disease is not noticed until the leaf axils and sheaths have become infected, and are dark brown in colour, it is probable that treatment by excision of diseased leaves and applications of a fungicide will be ineffective. If the disease is present only on portions of the laminae, distant from the axil, prompt removal and burning of the diseased tissue and spraying with a fungicide, coupled with attempts to promote drier conditions, should save the plants. If plants which have been sprayed need to be watered the water should be given by sub-irrigation or applied so that the spray deposit is not washed away.

References

Ashby, S.F. (1929). Strains and taxonomy of *Phytophthora palmivora* Butler (*P. faberi* Maubl.). *Trans. Brit. mycol. Soc.* 14, 18-38.

Gadd, C.H. (1924). *Phytophthora faberi* Maubl. *Ann. Roy. Bot. Gardens, Peradeniya,* 9, 47-89.

Schwarz, M.B. (1927). The heart and leaf rot of orchids caused by *Phytophthora omnivora* De By. *H. van Inqen. Soerabaja.* (Abs. in *Rev. Apl. Myc.* 7, 100, 1924).

Thompson, A. (1929). Phytophthora species in Malaya. *Mal. Agri. J.* 17, 53-100.

(1935). Diseases of the potato plant at Cameron Highlands. *Mal. Agri. J.* 23, 410-420.

(1950). The Introduction of Amelonado cocoa from the Gold Coast to Malaya. *Mal. Agri. J.* 33, 209-218.

(1958). A disease of Orchids caused by the fungus *Phytophthora palmivora.* M.A.H.A. Magazine: XV 2, 61-66.

Thompson, A. and Johnston, A. (1953). A Host List of Plant Diseases in Malaya. *Mycol. Papers* No. 52 C.M.I. Kew.

A DESCRIPTION OF EXISTING PRACTICES IN THE CULTIVATION OF MANDARIN ORANGES IN TELOK ANSON AREA

BY

R. J. R. BARRETT,

Agricultural Officer.

Introduction

It is uncertain how long before the Second World War the cultivation of Mandarin Oranges was practised in the Telok Anson area. Milsum (1) reported in 1937 that Mandarin Oranges was "planted fairly extensively in small orchards by Chinese particularly near the large towns." What appears to be the oldest orchard in the Telok Anson area, however, was planted in 1937/38.

Prewar planting was close to the town and confined mainly to the south-east bank of the Perak River. A small acreage was planted up during the war. The retail price for fruit in each of the years 1947 and 1951 was over 90 cents per kati. Such prices offered strong encouragement to further planting, and most of the present area has been developed since the war. At the present time there are over 3,200 acres of Mandarin Oranges planted in the Telok Anson area.

Commercial orchards now extend intermittently along both banks of the Perak River from a point three miles above Telok Anson to 12 miles below the town. There are also orchards along the banks of the Sungei Bidor and Sungei Tunku, tributaries which join the Perak River at Telok Anson. The majority of the orchards are within half a mile of the river banks. (Map I).

The Fruit

Milsum (1) quotes Professor Tanaka as giving the Mandarin Orange most commonly grown in Malaya, the name of *Citrus suhuiensis Hort.* The fruit of this species, when grown under local conditions, is described by Milsum as "2.25 to 2.75 in. diameter and 2.00 to 2.25 in. high, skin shining greenish to yellowish green in colour with undulations showing the interior segments" (Plate I).

The fruit of the better quality grades is quite juicy, with a flavour popular to the Asian palate. It is the general opinion that the flavour improves with keeping for three to four days after plucking. This factor is convenient for marketing, as the fresh fruit generally reaches the retailer after about this interval. For European tastes the flavour is generally not tart enough.

Soil Type

The main soil type on which the orchards are situated is a reddish-brown river alluvium. The silt fraction varies in the different localities with a subsequent variation in soil texture from a stiff clay to a silty clay.

In view of the situation of the orchards near to the river banks there is a tendency to an excessively high water table. Bunding and drainage are required, and the initial capital cost of establishing orchards in this area is high. The bunds may be up to 10 ft. wide at the base and 4 ft. high. Drains are usually dug between every alternate row of trees, and may be 3 to 4 ft. wide and 2 to 3 ft. deep.

Propagation

Propagation is invariably from marcots. Mother tree selection, if practised, is based on visual observations of quantity and assessment of quality by taste. There are no known cases of systematic recording as a basis for selection. Marcots are taken from branches near the periphery about half way up a mature tree. Apart from the ease of handling at this height the growers claim that marcots taken from nearer the ground or the top of the tree, do not grow so well nor fruit so early.

Having selected the branch for marcotting, the grower prepares the marcot, the rooting medium being soil from the drains or some other such fertile source. When roots appear, about two months later, the marcots are removed to a nursery bed and left for about four months to harden off.

Most growers keep stocks of marcots at different stages of growth. Those surplus to their own need find a ready sale both in and outside the Lower Perak District, at prices between $1.50 and $2.50. Throughout this article the Straits Dollar is used as the unit of currency: $1 = 2s. 4d. Sterling. The Kati is used as a unit of weight: 1 Kati = 1.33 lb., 100 Katis = 1 *picul.*

Spacing

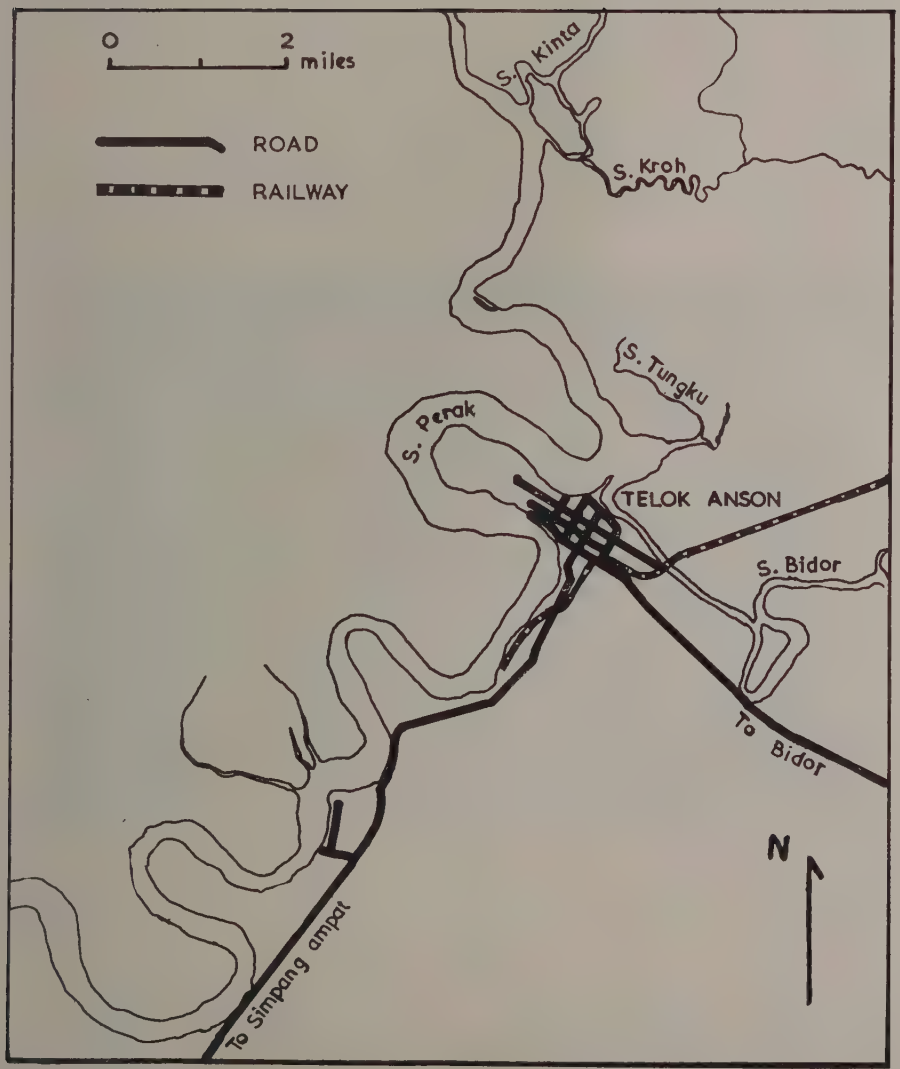
When planting first started in the Telok Anson area before the war, the common spacing was 14 x 14 ft. square. This was a direct relic from the experience of orange growing in the Canton area, from where many of the growers and plants originated. After a few years it was found that the trees grew bigger under Malayan conditions, and the need for greater planting distances between the trees was realised. In the Telok Anson orchards planted prewar at the close spacing, the branches are intergrown, with the result that growth has been forced upward and the fruiting area reduced.

Triangular or square planting is now favoured, at distances of between 24 and 28 ft. At these distances, even with heavy manuring, the trees maintain a mushroom shaped canopy, giving a full fruiting surface.

Manuring

Heavy organic manuring is practised by the growers. Prewar and immediately postwar, human excreta formed the main basis of this manure, but tightening up of Health Office regulations has limited its use. The main ingredients now used are fish waste and groundnut cake. These materials, before use, are stored in large porcelain jars placed

MAP I



Map showing region of extensive Mandarin orange cultivation along the banks of the Sungei Perak and its tributaries, around Telok Anson.

PLATE I

Mandarin oranges

amongst the trees in the orchard. The jars stand about 2 ft. 8 ins. in the height and are about 2 ft. across at the widest part.

When human excreta was used, jars were filled about two-thirds full with night soil, and then left for nearly two months. They were then filled to the top with groundnut cake, and the mixture was considered ready for use about 1 week later. Such a jar provided sufficient manure for from six to eight trees.

Nowadays, 15 to 18 katis of moist fish waste are put into a jar and two weeks later 35 to 40 katis of groundnut cake are added. This mixture is then left for another eight weeks during which time rapid decomposition occurs, and the resulting "liquid" is applied to the trees. In rainy weather the manure is put into pockets around the periphery of the tree. In dry weather it is placed on top of the ground within the periphery.

In a productive orchard this manure is applied about six times in the year. With local fish waste at $6 per *picul.* and Siamese or Hong Kong groundnut cake at $22 per *picul,* manuring will cost about $1.10 per tree per year.

When the trees are young, intercropping with vegetables and other food crops is generally practised. This is an economic necessity in most cases besides being an effective method of weed control. As the trees grow and their canopies expand, so intercropping decreases. and clean weeding with *changkol* (hoes) is undertaken. Without this clean weeding various grasses, including *lalang* (*Imperator cylindrica*). soon establish themselves. The operation of clean weeding is the major item of maintenance costs and at first sight it would seem that some alternative, less demanding in hard physical labour and money should be feasible. Even if the growers did favour a close grass sward, however, the drains and low tree canopies would preclude the effective use of rotary motor cutters; the use of the swinging hand slashers, such as are used under rubber and palm trees, would also be restricted by the tree canopies. As it is, the method of manuring described in paragraph 15 requires partial clean weeding. In addition it is noticeable that in the low lying orange growing areas around Telok Anson, no orchard which does not practise clean weeding gives reasonable returns.

Little systematic pruning is done. although as mentioned below, it might well be helpful in disease control.

Pests and Diseases

Insect pests include Shield Bugs (*Rhynchocoris sp.*), Fruit Flies (*Dacus sp.*) and Aphids (*Doralis citricidus* and *Toxoptera citricidus*). The Shield Bug pierces the skin of the developing fruit in order to suck the juices. Around the point of puncture the fruit develops a hard area, spoiling the quality. The Fruit Fly lays its eggs on the young fruit and the developing grubs spoil the fruit by boring inside. Secondary bacterial rots frequently occur around the point of puncture, and the fruits often drop prematurely.

Many of the growers spray their trees with insecticides, usually formulations of BHC, but no really effective measures have yet been found to counter these two pests. It is stated that growers sometimes attempt to catch the Shield Bugs with nets. Aphids, by attacking the young shootlets, reduce flowering. These pests are controlled by insecticides, Malathion being increasingly used of recent years.

The most serious disease is a form of collar rotting, Gummosis. This produces a blistering of the bark around the base of the tree, with oozing of gum from the ruptured bark. This ring-barking effect leads to death of part or all of the tree. The causative organism has been tentatively identified as *Phytophthera parasitica.* Various treatments have been tried, including drastic tree surgery coupled with application of tar and other such tree dressings. Whilst trees are often apparently cured by such treatment, the occurance of the disease definitely decreases during the dry part of the year, only to reappear in the following wet season. Repeated marcotting, coupled with the heavy manuring practised, produces trees of a low branching habit with the leaf canopy extending to ground level. In such circumstances a humid atmosphere is maintained around the collar of the trunk, and provides ideal conditions for fungal growth. In spite of the obvious connection between the disease and humid conditions, farmers are loth to carry out any pruning to assist aeration around the collar region.

Flowering, Fruiting and Harvesting

In any orchard there will be some ripe fruit ready for harvesting at all times of the year. On trees which are well spaced, well manured and maintained, however, four flowering and harvesting climaxes can be detected. The onset of flowering depends to a certain extent on rainfall; after the new leaf flushes, the flowers appear singly, subtended by five or six young leaves on the end of small shootlets.

Although four flowering climaxes have been mentioned, they are not each of equal magnitude. On well manured trees two of the climaxes may be described as larger than the other two; on less healthy or overcrowed trees, often only one climax may be discernible.

The period from flowering to harvest is about seven months so there is overlapping of the crops. On a vigorous tree, just before harvesting of a major crop, there will be -

(a) the near ripe fruit of the major crop
(b) the half ripe fruit of a minor crop
(c) the flowers of the next major harvest

From this the need for regular heavy manuring will be appreciated.

The fruits are harvested by hand or by small net cups on the end of long poles. The time of plucking is just as the dark green shiny colour begins to fade. From good trees yields of up to two *piculs* of fruit per tree are claimed. About one to one and a half *piculs* per tree is an average yield for most orchards.

Financial Considerations

One acre of potential orange land in the Telok Anson area will cost about $600. It is difficult to say how much it would cost to provide drains and bunds for one acre of orange land preparatory to planting, as different situations require different lengths of bunds; an average estimate, however, might be as follows:—

20 chains of drains — 4 ft. x 3 ft. cross section at $25 per chain	$500
10 chains of bunds — 6 ft. across at base x 4 ft. high at $40 per chain	$400
Total	$900

A well tended orchard should begin to yield after three years. An estimate of the cost of essential materials per acre during these three years would be:—

108 marcots at $2 each	$216
Manure 1st year at 50 ct. per tree	$ 54
„ 2nd year at 75 ct. per tree	$ 78
„ 3rd year at $1.10 per tree	$118
Total	$466

One hard working man can look after two acres of mature orchard, with a little help from his wife. If such a person intended to plant and bring two acres of orchard into production, using his own labour except for constructing drains and bunds, he would require about $4,000 capital; this is assuming that he can obtain an income during the first three years by intercropping with vegetables and other short term foodcrops.

When the wholesale price of Mandarin oranges was $70 per *picul*, the capital cost of establishment was soon repaid and orange orchards in bearing were changing hands at figures around six to eight thousand dollars per acre. With the expansion of the industry in other areas, such as Selangor and Negri Sembilan, the wholesale price for fruit has dropped to about $20 per *picul*; understandably, there is not now quite the same keeness to plant up new areas in the Telok Anson area.

Summary

This article describes the history, situation and the main operations connected with the Mandarin orange industry near Telok Anson.

Acknowledgements

Acknowledgement is made to Mr. Lin Chin Chee, Agricultural Assistant, (Cadet) for his help in collecting information used in this article.

References

(1) Milsum J.N., (1937): "The Local Mandarin Orange"—*Malay. Agric. J.*, 25, 234.

MASTER FARMERS OF MALAYA, X.
YIP WAH.

BY

T. SOCKALINGAM,

Agricultural Assistant i/c

Federal Experiment Station, Cameron Highlands.

Many of the farmers at Cameron Highlands can be counted amongst the most successful in the Federation. They are industrious, efficient and skilled in their trade and are interested in and readily act on the advice of the Department of Agriculture. There is, however, room for much improvement, particularly in proper soil conservation measures and intelligent use of fertilisers. Progress in the former is probably dependent on the granting of security of land tenure to the farmers through permanent titles or long leases, and the latter can be achieved through education to understand the value and use of the various organic and inorganic fertilisers.

The maximum and minimum mean temperatures at Cameron Highlands are approximately 72 and 56 degrees Fahrenheit respectively. This indicates that the climate is not too warm or too cold and is ideal for the cultivation of many temperate and sub-tropical vegetables.

The cultivation of vegetables is the most important industry at Cameron Highlands. The area under vegetables is approximately 1,400 acres and the estimated income from this source is approximately $6 million annually. Among the intelligent and industrious farmers who make a good living is Yip Wah who, due to his skill, can be called a "Master Farmer". Close examination of the methods used by Yip Wah and other good farmers show that success is due to the practice of good husbandry and to their experience of vegetables growing, acquired over the years.

Yip Wah, the Master Farmer, is now 60 years old, and lives at Tringkap Village with his wife and daughter. He came to the Highlands about ten years ago from Ipoh, where he had been cultivating vegetables. To help him and his family on the three acre farm he employs a female worker, at $60 a month with meals.

The farm is on fairly flat land adjacent to a stream. The beds are constructed against the slope and the main drainage is so designed that it prevents soil erosion during periods of heavy rain. By this system the top soil on the farm has been well conserved. In many other farms, where the cultivation is on the slopes, much of the top soil has been lost through neglect of proper soil conservation measures.

Yip Wah, when he constructs his vegetable beds, digs deeply until the sub-soil is reached. Many other farmers, after harvesting a crop, dig no deeper than six inches before reforming the beds for the next crop. Inadequate soil depth in such cases is entirely due to shallow

PLATE I

Yip Wah hopes to get a record crop from his two month old cabbages.

PLATE II

Yip Wah keeps a good check on pests and diseases by regular spraying.

PLATE IV

A plot of sugar peas interplanted with Chinese cabbages on Yip Wah's farm.

PLATE V

Cultivation on the hill slopes near Kea Farm.

digging. Yip Wah appreciates that deep digging thoroughly turns over the soil and leaves it in a loosened and aerated condition and gradually increases the depth of fertile top soil. It also facilitates the absorption of rain, encourages the activity of soil bacteria and enables the roots to penetrate the soil more easily. Plants can thus derive greater benefit from manure and fertilisers.

Yip Wah uses only good quality seed of recommended varieties, and experience has taught him that it pays to buy imported seed. Local seed is not always true to type and does not necessarily inherit and reproduce the characters of the parent plants. To ensure purity of strain, high percentage germination and healthy plants, he buys only from a reliable source. Yip Wah is one of the farmers who plant only recommended varieties. For instance, there are several varieties of cabbages which the Department of Agriculture has tested and recommended for local cultivation. These recommended varieties yield bigger crops and this in turn means larger profits to Yip Wah. The seeds are sown in boxes or beds with overhead shelter. Burnt soil mixed with rotted farmyard manure is used for sowing the seeds. The seedlings are thinned out as they grow and only the best seedlings are used for planting. Yip Wah is anxious to raise seedlings in boxes with standard composts, if he can find a simple and inexpensive means of steam sterilising the soil.

Yip Wah normally grows English cabbages, Chinese cabbages, leeks, tomatoes, sweet pepper, beetroot, carrots, french beans and sugar peas. Tomatoes and sweet pepper are grown during the dry season only as it is expensive and difficult to control leaf blight, which seriously affects them, during the wet season. English and Chinese Cabbages can be grown throughout the year. They are easy to grow and are among the most profitable vegetables, but Yip Wah appreciates the folly of growing the same crop throughout the year, and has taken the advice of the Department of Agriculture to practice crop rotation. As a result he has found that the incidence of pests and diseases is not so severe as when he grew cabbages only. He also understands that different types of plants make use of plant food at different rates, and sometimes at different levels; he also appreciates that leguminous crops such as French beans and peas are able to use nitrogen from the air. He therefore plants the three main groups—leaf and fruit crops, root crops and legumes one after the other. He said that before he practised crop rotation most of his time was spent in spraying insecticides or fungicides, but now he is able to devote more time to the other aspects of cultivation. He also emphasises that he gets better and larger crops now.

Yip Wah explains that he uses about 20 *piculs* of bean cake and prawn dust and 10 *piculs* of inorganic fertiliser per month. This amount is less than the quantity of fertilisers used by most of the other farmers. He makes a considerable saving on this item by using the fertilisers intelligently. Like the other farmers he does not use large quantities of prawn dust, which is poor in manurial value yet very expensive.

Instead he purchases balanced fertiliser mixtures which are available in the form of "Cabbage Mixture", which is rich in Nitrogen, and "Tomato Mixture", which is rich in potash and phosphate. To these he adds a proportion of bean cake and prawn dust and uses the mixture rich in nitrogen on his leaf crops and the other mixture on his root and legume crops.

Yip Wah, the Master Farmer, produces about 100 *piculs* of mixed vegetables per month. Monthly yield and profits from Yip Wah's farm and average yield and profits from a three acre farm for the district are given in Tables I and II respectively.

Table I

Average Yield and Profit per Month from Yip Wah's Farm.

Particulars	Gross Returns ($)	Expenses ($)	Net Income ($)
100 *piculs* of mixed vegetables @ $15 a *picul*	1,500		
30 *piculs* of fertilisers @ $20 a *picul*		600	
Insecticides and fungicides		50	
Wages		60	
Rent on land		10	
Vegetable seeds		30	
Tools, etc.		10	
Total:	1,500	760	740

Table II

Average Yield and Profit per Month from a Three Acre Farm for the District.

Particulars	Gross Returns ($)	Expenses ($)	Net Income ($)
80 *piculs* of mixed vegetables @ $15 a *picul*	1,200		
35 *piculs* of fertilisers @ $20 a *picul*		700	
Insecticides and fungicides		80	
Wages		60	
Rent on land		10	
Vegetable seeds		15	
Tools, etc.		10	
Total:	1,200	875	325

Yip Wah considers that future prospects are bright in the light of the improved Emergency situation. He hopes to keep some pigs, which it is not possible to do in the farm at present, as it is outside the village perimeter fence. In this way he anticipates being able to provide animal manure which is so important and so often neglected in farming practices in Malaya. He explained that sufficient waste materials suitable for pig fodder are available from his vegetable crops which at present are returned to the soil. He states that he will make some compost with part of the pig manure and use the balance as liquid manure on his crops, thus not only making a substantial saving on the purchase of bean cake and prawn dust, but also improving soil fertility by adding organic matter in substantial quantity. He is hoping to see the proposed Co-operative Marketing Society organised as soon as possible. When this is functioning he should be able to obtain a better price for his vegetables.

The soil at Cameron Highlands is not very fertile, but Yip Wah and the other farmers who work hard and apply sound systems of good husbandry are making a good living. Yip Wah is a fine example of a successful farmer and his farm is an outstanding demonstration of his skill, and is promoting a spirit of friendly rivalry among the other farmers.

NOTES ON CURRENT INVESTIGATION AND EXTENSION WORK

(April to June, 1959)

Weather

Weather conditions were generally favourable during the quarter and initial main crop rice cultivations in North Malaya made good progress.

Padi

Research

The varieties Engatek, Indai Empati, Kao Pudart and Nachin 5039 have completed three years trial with Subang Intan 117 as control at Kepala Batas Padi Test Station, Kedah. The Nachin selection gave better yield but because of its poor quality and susceptibility to lodging it is not recommended for that area.

At Kuala Kurau and Sg. Manik Padi Test Stations, Perak Seraup 50 and 99, after three years trials, were found to give significant increases over Serendah Kuning 48 which is the standard variety. Under Kuala Kurau conditions Seraup 50 may be expected to give increases in yield of 37 per cent or 998 lb/acre and in Sg. Manik an increase of 18 per cent or 310 lb/acre. Seraup 50 was found to be a very adaptable strain with little lodging.

The final series of three year trials on the remaining Ser. Kun. selections (not previously tried) were completed at Ulu Klawang, Ampang Tinggi and Kendong Padi Test Stations, Negri Sembilan. Previously Ser. Kun. 11 was found best and significantly outyielded unselected Ser. Kun. which is the standard kampong variety. In these last trials Ser. Kun. 11 was used as control and gave consistently less yield than Ser. Kun. 60 at all three stations. The overall increase of Ser. Kun. 60 over Ser. Kun. 11 was found to be 9 per cent. Ser. Kun. 11, 3 and 23 are recommended for certain circumscribed regions but Ser. Kun. 60 has proved more adaptable to the varying conditions in the State. Ser. Kun 60 is, therefore, to be preferred because of its high yield and general adaptability.

Of the trials still in progress, the most promising are probably those of Seri Raja selections in Perak and Anak Naga selections in Kelantan. It was found in these trials that the best selection gives at least 20 per cent higher yield than the unselected local material.

Agronomic Investigations and Extension.

Trials concluded in the 1958/59 seasons have shown very clearly that a marked decrease in yield can be expected if padi seedlings are transplanted after they reach the optimum stage of development. It has also been shown that manuring of nurseries will not significantly increase

the yield of overage seedlings. Examination of the results of formal trials conducted over the past three seasons have shown that a delay of 30 days in transplanting the padi seedlings has resulted in a drop in yield of 780 lb. of padi per acre valued at $85. A delay of 60 days, however, has resulted in a reduction in yield of 1,720 lb. of padi per acre worth $190. There is, therefore, every incentive to transplant using young seedlings which have developed only to the five to six leaf stage and this has been defined for varieties of differing maturation period.

The results of a series of "type of phosphate" trials have been examined. It has been shown that in the presence of nitrogen and potash fertilisers highly economic yield increases have been obtained from the application of 100 lb. P_2O_5 per acre in the form of insoluble rock phosphate at experimental stations in Kelantan, Negri Sembilan and Penang. There is evidence of a residual effect from water insoluble phosphatic fertilisers. In view of the fact that no yield differences have been detected between the various sources of insoluble phosphate tested, it is recommended that the cheapest source, namely rock phosphate from Christmas Island, should be utilized.

Results from NPK factorial trials conducted in various parts of Kedah indicate that responses to application of fertiliser varies considerably with soil type and other variable factors. In some districts response to application of nitrogen is such that heavy dressings induce lodging, while equivalent dressings in other areas improve both growth and yield.

A trial conducted at Telok Chengai P.E.S. examining methods of disposal of straw in the padi field, indicates that the traditional technique of burning the straw after harvest and applying bat guano every three years, if it is accompanied by an annual application of nitrogenous fertiliser, is more effective than other forms of management which involve either spreading or removal of the straw for purposes other than soiling in cattle sheds. Composting of straw has not been tested but in future seasons this practice is to be introduced as a new treatment.

The use of limestone on long developed *gelam* soil at Pulau Gadong, Malacca, has been the subject of casual investigation in recent years. Substantial yield increases appear to have been obtained as a result and a marked residual effect has been noted. These results have been supported by evidence from observations in other districts and in consequence the value of limestone in increasing the yield of padi is to be more carefully studied in the coming season.

Very interesting results have been obtained from the use of two new fertiliser formulations Chissophos (16 : 20 : 0) and Chissophoska (14 : 12 : 9). These fertiliser compounds are available at highly competitive prices and provide nutrients in a form which is particularly suitable for padi. Pilot trials conducted in Kelantan in the 1958/59 season are to be followed up in both north-east and north-west Malaya in the coming season.

During the off season a number of pilot investigations were conducted at Bukit Merah Padi Test Station, Province Wellesley and at Kuala Lumpur. The value of cattle manure and superphosphate for dry nurseries has been confirmed in these investigations. An application rate of 1 lb. of well rotted cattle manure per sq. ft. of nursery appears to be near the optimum requirement. Cattle manure used in wet nurseries on the other hand appears to reduce germination and establishment. Hand weeders of the type used in Japan have been tested in Kelantan and operate satisfactorily provided the water is not too deep. Attempts to develop a new technique in green manuring of padi fields has met with some success in both Kedah and Kelantan and is to be followed up next season.

A substantial number of investigations have been carried out by the Colombo Plan officers at Bukit Merah Padi Test Station during the off season. A number of these are complementary to our own programme but there are also new investigations which are of considerable interest. The more important are examination of the value of furnace slag from iron and nickel foundries in increasing the yield of padi; the testing of fertiliser placement techniques using ball fertiliser and the testing of types of fertiliser not previously tried in Malaya. In addition, a number of pilot observations are being conducted on the most suitable methods and times of applying fertiliser and the influence on growth and yield of applying iron ore, limestone and organic matter to the padi field before transplanting. Cultural techniques including features such as depth of transplanting, spacing and use of herbicides are also being examined. A most important aspect of the work conducted by the Colombo Plan officers in the 1958/59 main season has been a detailed study of the components of yield of the padi plant.

Harvesting was completed in June, and out of a planted acreage of 860,000 the area harvested was 819,000 acres, 23,000 acres fewer than in the season 1957/58. Adverse weather conditions, mainly the prolonged drought which occurred throughout the country in the months of December to March, were responsible for the destruction of most of the area unharvested. The States of Kedah and Perlis were particularly badly affected.

Total production of padi in the 1958/59 season was 267 million gantangs, which is 12 per cent below the record crop of the 1957/58 season, but just above the average for the past 10 years.

Harvesting of both upland dry and lowland dry padi for the 1958/59 season was completed during the quarter. Out of a total of 56,000 acres planted, 55,000 acres were harvested, with an average yield per acre of 204 gantangs.

Rubber

Distribution of rubber planting material to smallholders for both new and replanting, amounted to 84,172 yards of budwood and 1,360,280 clonal seedling stumps during the period. As anticipated, the quantity of material distributed was much greater than that distributed in the

first quarter of the year, weather conditions being more suitable for planting. Large surpluses of planting material of both budwood and stumps still exist.

All States in the Federation now have areas under the Block New Planting of Rubber Scheme, many associated with Land Development Authority schemes.

Coconuts

An *Oryctes* insecticidal field trial has been conducted recently at the Federal Coconut Experiment Station, Telok Bharu, to observe whether the insecticides BHC, Dieldrex Extra, Endrex, Basudin, Napthalene and p-Dichlorobenzene have any effect in reducing *Oryctes* attack. This experiment is not yet complete but a laboratory test to find the effects of certain insecticides on *Oryctes* showed that BHC and Basudin gave encouraging results.

At the station *Oryctes rhinoceros* has developed into a serious pest and is causing severe damage to young palms. Estates near the station have co-operated in an eradication programme and possible breeding grounds on these estates have been destroyed. The present source of infection appears to be the nearby area of smallholdings and it is difficult to ensure eradication of breeding grounds in these areas.

Clearing and development of a new 35-acre block at the Federal Coconut Experiment Station, Telok Bharu, has continued but has been hindered by wet weather. Field drains have been cut and eradication of lalang has started. Approximately 950 selfed and open pollinated nuts from selected mother palms have been received from various sources during the quarter. In addition, 40 high yielding palm seedlings have been received from one estate and planted out.

The rise in the price of copra during the latter half of 1958 and early 1959 came to an end in the second quarter, and prices have steadied at between $40 and $45 per *picul*. The rise in price is associated with a world-wide decline in copra production, which is very marked in Malaya. It is evident that urgent measures to resuscitate the coconut industry are required, and that replanting of extensive acreages on the West Coast, especially in Johore, needs to be undertaken as a measure of urgency.

Drainage work in the coastal coconut areas of Johore continues. The full benefit of the schemes will not be felt until smallholders undertake the reconstruction of the internal drains of their holdings. At present few of them are prepared to do this, with the result that the standing water cannot escape to the new D.I.D. drains.

In the first quarter of the year an economic survey of Pulau Tioman was undertaken by staff of the Department in conjunction with staff from the Co-operative Department. It was found that there are about 1,200 acres of coconuts on the island, but that yields per acre are very poor, averaging about three *piculs* only. The price of copra on the island is about $10 per *picul* lower than at Mersing, while nuts are priced at about half that obtained at Kuantan.

Coffee

Coffee in a formal manurial trial on deep peat soil at the Federal Experiment Station, Jalan Kebun, is growing satisfactorily. Trees in plots which are mulched appear to be particularly prone to damage by termites and it may be necessary to abandon mulching as a treatment in the trial.

The price at Klang of dried Liberian coffee beans at the end of June was $150, an increase of $15 per *picul* over the quarter

Cacao

Experiments on die-back were continued and more evidence obtained that die-back may be non-pathogenic in nature.

It was thought that fungi *Botryodiplodia theobromae* and *F. decemcellulare* were associated with die-back of cacao trees but experiments to establish this gave no positive results.

The presence of grass weed under cacao is frequently a serious problem until such time as the canopy of the cacao tree closes. It has been shown that judicious pruning assists in obtaining rapid canopy cover but in order to counter heavy infestation of grass weed in early life, observations have been put down to study chemical methods of control. In these observations, trade preparations of Dalapon; 2.4 D, 2.4.5.T and sodium chlorate are being tried. Preliminary indications are that sodium chlorate used at rates up to 15 to 20 lb./acre appears to be most effective. Dalapon at 10 lb. per acre and over appears to be harmful to cacao. These investigations are being further developed.

Pineapple

There was little change in the condition of the large smallholder acreage of pineapples intended for canning; fruit price paid by canneries remained at a depressed level, and as a consequence interest in the crop remained slight. Little or no fertiliser is being applied, weeding and maintenance generally is neglected, and fruit yields have declined still further. Should the market for canned pineapples expand, it would be difficult for Malaya to take early advantage of the fact, since fruit supplies are now strictly limited, and are likely to decline further, and a rapid expansion of production will not be possible.

Fruit

The citrus collection in Botany Division now contains young seedlings of 57 varieties or strains and most of them are growing well. Some of those have been passed to the Agronomy Branch for tests in their value as rootstocks.

Heavy flowering of many fruit trees in the early part of the first quarter of the year promised a bumper fruit harvest in mid-year, but drought conditions in January to March resulted in premature fruit drop, and it now appears that the mid-season harvest will be lighter

than usual. Towards the end of the second quarter some supplies of rambutan began to come forward. In North Malaya harvesting of *Limau Chembol* and Mandarin orange commenced, but the crop is reported to have been light.

Fruit Preservation

Samples of canned banana puree were prepared from the varieties —*pisang mas, pisang raja, pisang rastali* and *pisang embun.* The best product was obtained from *pisang embun.*

Tea

Certain of the tea clones grown at the Federal Experiment Station, Cameron Highlands, appear to be resistant to attack by blister blight. This feature is thought to be of considerable importance and consideration is being given to bulking material of these clones for early trial.

Establishment of tea at the Federal Experiment Station, Gajah Mati, Kedah, has not been successful. The severe drought which occurs each year in this area is responsible for poor establishment. Observation plots of tea at the Federal Experiment Station, Jerangau, Trengganu, have established well. Both seedling and vegetatively propagated tea are now growing well on this station and an observation has been laid down to indicate which of three cover crops is likely to be most suitable for tea in this area.

Foodcrops

Interesting results have been forthcoming from a potato variety trial at the Federal Experiment Station, Cameron Highlands. In this trial seven varieties obtained from Holland are compared with local material. One of the imported varieties, Van Haeringen 52-03, appears to be highly resistant to infection with blight (*Phytopthera infestans*) and has yielded well in the first crop since importation.

Pasture and Fodder

Two promising grass species, *Brachiara brizantha* and *Panicum trichocladum* have been under close examination for several years at the Federal Experiment Station, Serdang. The grasses have for some time been strip grazed by cattle and the *Brachiaria brizantha* (signal grass) has stood up well to this treatment. *Panicum trichocladum,* on the other hand, has suffered badly as a result of grazing and is gradually dying out. It seems likely that *Brachiaria brizantha* will prove to be satisfactory in Malaya, as either a fodder or pasture grass, provided that in its role as a pasture grass controlled grazing is ensured and it is not used for free range purposes.

A number of fodder grass species at present under observation at the Federal Experiment Station, Kuala Lumpur, have been established on deep peat soil at the Federal Experiment Station, Jalan Kebun. A

number of strains of *Stylosanthes gracilis* and closely related species grown in Kuala Lumpur have been despatched to Kelantan for trial. Several varieties of Lucerne (*Medicago sativa*) have been imported from various sources. These are being tested in Federal Stations in Selangor and Kelantan and in the Cameron Highlands. Three varieties of sorghum have also been imported and are being tested at the Federal Experiment Station, Kuala Lumpur.

Soil Survey

The reconnaissance and schematic survey of the sedentary soils of Kedah was resumed in April this year and since then reconnaissance surveys have been continued and completed in north Kedah and good progress has been made in south and central Kedah. In north Kedah work was concentrated in the Sungei Seri-Padong Senai area where approximately 23,000 acres were surveyed at reconnaissance level.

In south and central Kedah work has been carried out in the Gurun-Jeniang-Gajah Puteh-Pendong quadrangle and the boundary between the Gajah Mati and Rengam soil associations has been fairly accurately delineated.

Detailed reconnaissance work has also been carried out in the Gurun-Jeniang-Bukit Selambau-Sungei Pantai quadrangle. Work is now in progress in the Baling area of South Kedah and in the Sik Valley.

Field work on the Kelantan upland soil survey was recommenced towards the end of the quarter and a large scale field trip in the Sungei Lebir-Sungei Aring area was started on 25th June.

Soil samples from the proposed Ayer Hitam, Negri Sembilan, development area have been inspected and a provisional map of the area drawn.

Field work on the Maran Road (Phase I) Development, Pahang, has been completed and practically all the area was found to be suitable for rubber cultivation. No areas of very rich soil were found suitable for tree crops which require high fertility. The soils of the area were found to vary considerably within rather narrow limits so that without very detailed mapping, which is impracticable under jungle conditions, soil boundaries could not be accurately delineated.

The analysis of samples of padi plants grown on *bris* soil in tank experiments is nearing completion. The results to-date show that nitrogen and phosphate fertilisers are essential for satisfactory growth of padi in *bris* soils. *Bris* soils are also deficient in iron and potash but this has little influence on the yield of padi. Deficiency symptoms coupled with reduction in yield due to lack of elements may result if padi is grown continuously.

Ground nuts planted on *bris* soils gave a good response to phosphatic fertiliser. Lime, potash, nitrogen or trace elements when used with the phosphate did not show better growth than by using phosphate alone.

In tank experiments with the *gelam* soil from Tanjong Minyak, Malacca, an attempt was made to grow okra as an off-season crop on the sub-soil. It was found that the seed did not germinate and transplanted seedlings died in the tanks in which the soil was kept under water during the padi season. These tanks received complete fertiliser treatment. Okra seeds germinated and made very good growth in the sub-soil which was drained and fertilised even with a low pH of 3.6. It appears from these experiments that a combination of draining, liming and fertilising are necessary to improve *gelam* soils. Okra seedlings planted on the top soil (*gelam*) were given complete fertiliser and are growing satisfactorily.

Farmers Associations and Clubs

The Department has been closely associated with the formation of many of the Farmers Clubs now in being, and during the quarter further Clubs were started in Kelantan, Trengganu and Negri Sembilan. In the States of Kelantan and Trengganu progress has been particularly rapid, and the various associations are already playing a valuable part in raising the standard of farming generally.

STAFF NOTES

(Period 1st April to 30th June, 1959)

Honours and Awards

Enche Tak bin Haji Daud, P.J.K., Agricultural Development Officer, Taiping, and Mr. Yap Chin Hee, Registrar and Bursar, College of Agriculture, Serdang, were awarded the *Ahli Mangku Negara*, Mr. W. P. Panton, Soils Geologist, Headquarters, was awarded the Honorary *Ahli Mangku Negara*, by H.M. the Yang di-Pertuan Agong, on the occasion of His Majesty's birthday.

Mr. P. Class, State Agricultural Officer, Johore, and *Orang Kaya Indera Pahlawan*, Ungku Wan Abdul Aziz bin Ungku Haji Wan Abdullah, Acting Agricultural Officer, Pahang, were awarded Silver Medals by H.H. the Sultan of Pahang, on the occasion of his Silver Jubilee.

Appointments

Name	*Appointment.*	*Date*
Ajit Singh Sidhu	Agronomist, Federal Experiment Station, Serdang	7.5.59
A. L. Barcroft .... (Dy. Director of Agriculture)	Ag. Director of Agriculture	12.6.59
G. S. Keeping .... (Asst. Director (Field))	Ag. Deputy Director of Agriculture	12.6.59
J. L. B. Hitchcock .... (Senior Agricultural Officer, Grade A)	State Agriculture Officer, Kedah	21.6.59
T. R. Dickinson, P.J.K. (Senior Agricultural Officer, Grade A)	Ag. Asst. Director (Field)	30.6.59

Promotions

J. S. Ure .... (Senior Agricultural Officer, Grade B)	Senior Agricultural Officer, Grade A	1.1.59
G. W. Arnott .... (Research Officer)	Senior Chemist (Senior Research Officer, Grade B)	25.6.59
F. N. G. Conaty .... (Senior Research Officer, Grade A)	Assistant Director (Research)	25.6.59

Retirements

Wan Abdul Aziz bin Ungku Haji Abdullah (*Orang Kaya Indera Pahlawan*)	Ag. Agricultural Officer	13.5.59

P. G. Coleman	....	Ag. Director of Agriculture	.... 13.6.59
Tak bin Haji Daud, A.M.N., P.J.K.	....	Agricultural Development Officer	13.6.59
J. K. Coulter	....	Asst. Director (Research)	.... 25.6.59

Leave

The following officers have returned from leave:—

G. F. Darnell	....	Agricultural Officer	.... 7.4.59
J. L. B. Hitchcock	....	Senior Agricultural Officer	.... 3.5.59

Notes on Retiring Officers

Mr. P. G. Coleman

The departure on leave prior to retirement of Mr. P. G. Coleman, Acting Director of Agriculture, in June 1959, is particularly significant, because it marks the end of another era, namely the severing of the link with the pre-war generation of expatriate officers who served in the Department of Agriculture.

Mr. Coleman was born in Kuala Lumpur, his father being a senior member of the Education Department, and although he left Malaya during his school days and for training at Cambridge University and the Imperial College of Tropical Agriculture, Trinidad, his life and interests were centered in this country. He joined the Department in July, 1949, as an Agricultural Officer. Apart from the break caused by the war, during which period he was a prisoner, Mr. Coleman served continuously in the Field Branch, where he occupied posts in the States of Perak, Penang, Kedah, Perlis and Kelantan. In 1958 he was appointed Assistant Director (Field), and was subsequently promoted to Deputy Director of Agriculture. From May, 1958, until his departure in June, 1959, he acted in the post of Director of Agriculture.

His departure constitutes a serious loss to the Department, and the benefit of his leadership and experience will be sorely missed. Mr. Coleman will probably be best remembered for his quiet, unassuming and friendly manner, his capacity for doing the job with the minimum of fuss, and the efficient way in which he ran the Department during a period of serious staff shortage. He had a first class knowledge of the Malay language and customs and his ready sense of humour and ability to joke in the local dialect ensured his popularity with the ra'ayat.

Mr. and Mrs. Coleman will be missed by a wide circle of friends both within and without the Department, and we wish them every success in the future.

Mr. J. K. Coulter

Mr. J. K. Coulter, Assistant Director (Research), left Malaya on leave prior to retirement on 26th June, 1959. Mr. Coulter was appointed on 18th December, 1947, and arrived in Malaya in January, 1948, when he took up his appointment as Chemist in the Research Branch, Soils Division, under Dr. S. G. Willimott.

He received his initial professional training at Queen's University, Belfast and subsequently at the University of Cambridge. Late in 1949 he was appointed to act as head of the Soils Division and remained continuously in that post until he became Assistant Director (Research) in December, 1957. In addition to his duties, while in the Soils Division, he also acted on three occasions as head of the Chemistry Division of the Research Branch.

During the past ten years the work of soil surveying for the mapping of potential agricultural areas has assumed increasing importance, especially in relation to the detailed surveys required for various land development schemes. Under Mr. Coulter, both the Field and the Laboratory staff of the Soils Division were expanded considerably and he worked enthusiastically towards the replanning of the work of the Soils Division to meet the heavy demands imposed upon it.

He was an author of considerable merit and has written a number of articles for the Malayan Agricultural Journal, which have made a valuable contribution to our knowledge, particularly of Malayan peat soils and oil palm nutrition. He has a practical approach to agricultural problems and travelled extensively both inside and outside Malaya in order to obtain first hand knowledge of his work. He was well known in Malayan scientific circles and acted for a time as Hon. Secretary of the Malayan Scientific Association.

Mr. Coulter was a keen sportsman, and played rugby football regularly for the Selangor Club, and on occasions for the Selangor State team. He was also an enthusiastic tennis player. He was in every way a large man, and the value of his advice, which he so freely gave, will be sadly missed, not only in the Department, but also by other organisations with which he was associated. Both he and Mrs. Coulter will be missed by a wide circle of friends.

Mr. Coulter has left the Department to join the Imperial College of Tropical Agriculture in Trinidad, and we all join in wishing him and Mrs. Coulter every success in their new surroundings.

Dr. R. G. Lockard

Doctor Lockard came to Malaya as a Canadian Colombo Plan expert in April, 1954. Apart from a short absence on leave in 1956, he spent five years attached to the Department of Agriculture, doing most useful research in Plant Physiology. In particular, he investigated nutritional aspects of the padi disease known as *penyakit merah* and the apparatus acquired for this work was also put to good use in studying the fundamental mineral requirements of cacao. The Bulletins written by Dr. Lockard, on the mineral nutrition of padi and cacao, are outstanding contributions to the improvement of Malayan agriculture and will doubtless become works of reference both here and abroad.

When Mrs. Lockard also joined the Department as Publications Officer in 1957, she worked with a quiet efficiency and energy which brought nothing but admiration from all who met her.

Dr. and Mrs. Lockard will long be remembered by their many friends in Malaya as two of the very best ambassadors of goodwill from North America. In offering our best wishes for their future we hope that they will one day bring their daughter to visit again the land where she was born.

Inche Tak bin Haji Daud, A.M.N., P.J.K.

Inche Tak bin Haji Daud joined the Department of Agriculture as an Agricultural Apprentice in 1925. He had a varied career at the School of Agriculture, in the Field Branch and finally with the Research Branch supervising field experiments on selection and breeding of rice. More recently he undertook the duties of Agricultural Officer, Perak North, in addition to his own during a period of acute shortage of Division I Officers and was deservedly promoted to the post of Agricultural Development Officer.

Since 1948 he has been stationed in North Krian and his work since then has been almost entirely confined to the State of Perak. The steady progress of padi variety selection work there has been in great measure due to Inche Tak's industry and interest and the recent release of high yielding strains is the culmination of his painstaking work over the last ten years. He has borne in mind at all times the need to convey the results of research work to the padi planters and his success in this object speaks for itself. His energy and public spirit are also exemplified by his service as Assistant District Warden, A.R.P., Batu Gajah, during the latter part of 1941, including the active period at the end of December. He was made a Member of the British Empire in the New Year's Honours in 1956, and in appreciation for his services to Perak, received the *Perak Meritorious Service Medal* in 1959. The award of the *Ahli Mangku Negara* in 1959 set the seal on a distinguished career.

Inche Tak is a man respected by all with whom he had to deal. His service has been notable for the ability, energy and initiative he has shown in the discharge of his duties and for his high integrity and courtesy in personal relationships with his colleagues and with the public. As might be expected, Inche Tak has chosen to live in Ipoh in his retirement and we wish him many happy years there. His retirement, however, does not mean the end of his agricultural work, as he has been reemployed by the Department of Agriculture, Perak, on the State establishment.

Ungku Wan Abdul Aziz bin Ungku Haji Abdullah, Orang Kaya Indera Pahlawan

Ungku Wan Abdul Aziz, Acting Agricultural Officer, retired from Government Service on 13th May, 1959, in order to contest the Pahang State Elections as an Alliance candidate, having served with the Department for 24 years.

Ungku Wan Abdul Aziz, the whole of whose service has been in his native State of Pahang, was appointed in 1935 as an F.M.S. Major Scholar, and assumed duty in 1936 after training at the College of Agriculture, as Malay Agricultural Assistant, Temerloh. He subsequently served as Agricultural Assistant at Pekan, as Assistant Agriculaural Officer, East Pahang, Kuantan, as Assistant Agricultural Officer, South Pahang, Temerloh, and finally acted in the capacity of Agricultural Officer, South Pahang, Temerloh.

Ungku Wan Abdul Aziz is a keen sportsman, and was an enthusiastic tennis, cricket and hockey player in his younger days. He remains a keen gardener, and has an extensive collection of cultivated and wild orchids. His knowledge of the history of Pahang is detailed and authoritative, and many of his friends will long remember his fascinating anecdotes of past events.

His Highness the Sultan of Pahang has recently been graciously pleased to appoint Ungku Wan Abdul Aziz as Mentri Besar of the State of Pahang, and his many friends in the Department all join in wishing him a long and successful tenure of this distinguished office.

STATISTICS

January to March, 1959

Rubber.—The market opened for the first quarter of 1959 on a confident note and the average price of rubber, as quoted by the Singapore Chamber of Commerce Rubber Association, improved to the 90 cents level during March. The average prices were as follows: International Type 1 (R.S.S. 1) January, 86.10, February, 86.02, March 89.44 cents per pound f.o.b.

News of impending steel strikes in America did not shake the confidence of the market and although a steel shortage would affect the output of motor manufacturers, it was felt that ample steel stocks were available to cover any foreseen stoppage of work. In any case, the importance of American purchases of natural rubber has been slowly decreasing, while Russian and Chinese buying has been well maintained.

Copra and Coconut Oil.—The downward trend in production is continuing, as can be seen from the statistics in Table VI. The copra price moved up during the period, from around $40 per pikul to $43.

Palm Oil.—Production of palm oil kernels increased during the first quarter, as compared with the same period, 1958. The price also improved steadily from £70 sterling in December, 1958, to £74 in March, per ton f.o.b.

Table I

AVERAGE MONTHLY PRICES PAID BY LOCAL DEALERS FOR SMALLHOLDERS' RUBBER, JANUARY TO MARCH, 1959

(dollars per pikul*)

Grades	Alor Star, Kedah			Seremban, Negri Sembilan			Johore Bahru, Johore		
	Jan.	Feb.	Mar.	Jan.	Feb.	Mar.	Jan.	Feb.	Mar.
Smoked Sheet No. 1	99.28	98.10	101.73	98.03	97.87	101.63	97.88	97.60	101.53
Smoked Sheet No. 3	93.28	94.60	98.20	94.08	95.02	98.80	94.13	94.82	98.80

* 1 pikul = 133⅓ lb.

This table has been compiled from statistics supplied by the Chief Statistician, Federation of Malaya.

Table II

RUBBER PRODUCTION

FEDERATION OF MALAYA

(long tons, dry weight)

Month	Estates		Smallholdings (Estimated)		Total	
	1958	1959	1958	1959	1958	1959
January -	35,800	37,600	25,400	27,200	61,200	64,800
February -	28,800	27,900	22,900	21,200	51,700	49,100
March -	28,400	28,500	20,300	21,100	48,700	49,600
April -	26,600		18,200		44,800	
May -	27,200		18,100		45,300	
June -	31,200		21,800		53,000	
July -	36,500		23,700		60,200	
August -	34,000		24,600		58,600	
September -	33,700		23,500		57,200	
October -	35,000		23,000		58,500	
November -	32,000		20,000		52,000	
December -	41,000		30,000		71,000	
Total -	390,2000		271,500		661,300	
Total 1957 -	369,073		268,024		637,097	

This table has been compiled from statistics published by the Chief Statistician, Federation of Malaya.

Production on smallholdings (estates of less than 100 acres) is taken as the total of purchases from smallholders reported by licensed dealers.

Table III

AVERAGE PRICES PAID IN LONDON FOR TEA

(s.d. per lb.)

For the Week Ending	Malayan		Ceylon		Indonesian		India				Africa	
							Northern		Southern			
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
17-4-59	3	4.55	3	6.66	5	5.31	4	6.72	4	1.08	3	1.38
24-4-59	4	1.57	5	6.39	3	6.50	4	8.13	4	3.94	3	1.56
1-5-59	4	1.99	5	10.09	3	5.08	4	9.54	4	4.07	3	2.63
8-5-59	5	4.35	5	10.55		Nil	4	8.30	4	5.31	3	2.49
15-5-59	5	6.30	5	11.27		Nil	4	9.54	4	6.14	3	2.00
29-5-59	3	11.35	5	10.59	5	11.89	4	9.20	4	4.45	3	1.85
5-6-59	4	2.83	5	10.98	3	10.14	4	8.99	4	3.36	3	3.19
12-6-59	4	4.33	5	10.31		Nil	4	8.75	4	1.69	3	2.71
19-6-59	4	1.32	5	9.64	5	0.00	4	6.70	4	3.51	3	2.13
26-6-59	5	5.55	5	5.97		Nil	4	6.12	4	3.89	3	3.05

Table IV

AVERAGE DEALERS' PRICES FOR DRIED LIBERICAN COFFEE BEANS GROWN IN SELANGOR*

(dollars per pikul †)

For the Week Ending	Klang	Kuala Langat
	$	$
4-4-59	130.00	132.00
11-4-59	130.00	130.00
18-4-59	130.00	130.00
25-4-59	133.00	130.00
3-5-59	135.00	130.00
9-5-59	130.00	130.00
16-5-59	130.00	125.00
23-5-59	130.00	125.00
30-5-59	130.00	125.00
6-6-59	135.00	135.00
13-6-59	135.00	138.00
26-6-59	145.00	145.00
27-6-59	150.00	148.00

* These are not the prices paid to smallholders, who sell freshly harvested berries to dealers for processing.

† 1 pikul = 133⅓ lb.

Table V

PRODUCTION OF PALM OIL AND KERNELS AND PRICES OF PALM OIL

(long tons, as declared by estates)

Month	Production of Palm Oil (long tons)		Production of Palm Kernels (long tons)		Average Price per Ton of Palm Oil *
	1958	1959	1958	1959	1959
					£ s. d.
January -	3,581	5,225	981	1,388	72 7 9
February -	4,460	4,824	1,192	1,356	73 13 6
March -	6,090	6,553	1,645	1,815	74 5 8
April -	5,748	5,268	1,552	1,404	75 1 9
May -	5,609		1,408		
June -	5,782		1,398		
July -	7,243		1,874		
August -	6,939		1,832		
September -	6,952		1,800		
October -	5,825		1,523		
November -	5,517		1,452		
December -	5,925		1,616		
Total -	69,671		18,273		

* F.O.B.

Table VI

PRODUCTION OF COPRA, COCONUT OIL AND COPRA CAKE
FEDERATION OF MALAYA

(tons)

Month	Copra Production						Coconut Oil Production *		Copra Cake (Poonac) Manufactured	
	Estates		Smallholdings (estimated)		Total		Oil Mills		Oil Mills	
	1958	1959	1958	1959	1958	1959	1958	1959	1958	1959
January	2,449	1,827	1,857	8,000	4,306	9,827	8,164	4,195	5,136	2,709
February	2,546	1,947	8,100	1,500	10,646	3,447	5,458	3,556	3,397	2,298
March	2,895	2,377	7,028	6,000	9,923	8,337	7,032	4,027	4,469	2,643
April	2,910	2,523	8,421	6,000	11,331	8,523	6,032	4,636	3,905	3,041
May	3,275		11,123		14,398		7,223		4,690	
June	3,431		3,447		6,878		7,485		4,886	
July	3,985		8,572		12,557		7,828		5,183	
August	3,575		9,200		12,775		7,168		4,669	
September	2,769		5,400		8,169		7,168		4,620	
October	2,519		6,000		8,519		6,939		4,472	
November	2,134		4,000		6,134		4,351		2,805	
December	2,332		4,000		6,332		3,703		2,442	
Total	34,820		77,148		111,968		78,551		50,674	

Notes:—1. The above table has been compiled from statistics published by the Chief Statistician, Federation of Malaya.

2. Estate copra production and coconut oil production are as declared by estates and oil mills, respectively.

3. Statistics of smallholding coconut oil production are not available.

4. Smallholding copra production for commercial purposes is estimated from the formula: imports + estate stocks (opening) + estate production + smallholding production = exports + local oil mill consumption + estate stocks (closing).

* Includes both refined and crude oil.

Table VII

SINGAPORE PRICES OF VARIOUS AGRICULTURAL PRODUCTS

(dollars per pikul †)

Date	Copra, Sundried	Coconut Oil *	Pepper, F.A.Q. Muntok White	Pepper, Gen. Muntok White	Gambier, Cube	Sago Flour, Lingga	Tapioca Flour No. 1	Oilcake, Round
5-5-59	44.00	70.00	146.00	156.00	46.00	8.62	17.00	16.50
11-5-59	44.50	71.00	142.00	152.00	46.00	8.37	17.00	16.75
18-5-59	45.00	72.50	144.00	154.00	46.00	8.50	17.00	16.50
25-5-59	44.75	72.00	140.50	150.00	46.00	8.50	17.00	16.50
1-6-59	43.00	72.00	136.00	146.00	46.00	8.50	17.00	16.50
8-6-59	42.50	68.00	134.00	144.00	46.00	8.62	17.00	16.00
15-6-59	40.50	66.50	133.00	143.00	46.00	8.75	17.00	16.50
22-6-59	40.50	65.00	134.00	144.00	46.00	8.75	17.00	15.50
29-6-59	36.75	62.50	132.00	142.00	46.00	8.75	17.00	15.50
6-7-59	36.00	60.00	132.00	142.00	46.00	8.87	17.00	14.25
13-7-59	36.50	60.00	135.00	145.00	46.00	8.75	18.00	12.00
20-7-59	35.50	50.00	133.50	143.50	46.00	8.87	18.00	13.50

† 1 pikul = 133⅓ lb.

* F.O.B. in second-hand drums.

‡ Nominal.

The above prices are taken from the weekly reports of the Singapore Chamber of Commerce.

Table VIII

MALAYAN AGRICULTURAL EXPORTS, JANUARY TO DECEMBER, 1958. ‡

Product	Net Exports in Tons			
	Year 1955	Year 1956	Year 1957	Year 1958
Arecanuts	13,679	11,228	9,625	4,938
Coconuts, fresh †	72,140	34,779	37,466	52,340
Coconut oil	91,176	103,132	100,031	67,483
Copra	75,076 *	82,549 *	71,718 *	55,906 *
Copra cake	56,404 *	66,174 *	73,208 *	72,453 *
Gambier, all kinds	66	96	209	555
Palm Oil	52,832	55,252	56,728	67,818
Pineapples, canned	27,756	30,377	37,671	41,417
Sago, flour	23,053	21,483	15,581	21,652
Sago, pearl	5,483	4,276	4,021	3,104
Sago, raw	18,709 *	18,522 *	14,006 *	13,383 *
Tapioca, flake	475	260	403	350
Tapioca, flour	3,979 *	3,753 *	1,573 *	1,920 *
Tapioca, pearl	5,470	5,630	5,222	3,333

† hundreds. * net imports.

‡ Statistics compiled from "External Trade of Malaya" (Colony of Singapore and Federation of Malaya) December, 1958.

METEOROLOGICAL SUMMARY, MALAYA, FEBRUARY, 1959

Locality	Air Temperature Degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes				At 4	At 1				Number of Days							
	A. Max.	B. Min.	Means of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	foot ° F	feet ° F	Total		Most in a day Amt.	Precipitation .01 in or more	Precipitation .04 in or more	Thunderstorm	Fog morning obs.	Gale force 8 or more	Total	Daily Mean	Per cent.
Ipoh, Perak	94.8	72.6	83.7	96.1	69.1	90.8	75.2			5.22	132.6	1.52	11	8	4			243.35	8.69	
Kuala Lumpur, Selangor	93.7	73.2	83.5	96.9	70.9	89.8	73.2			6.89	170.5	1.96	14	11	9	4		248.00	8.86	
Sitiawan, Perak	90.0	73.1	81.5	92.3	71.0	85.2	74.9	84.5	85.1	4.20	106.8	1.27	9	7	2	2		238.95	8.53	
Kuantan, Pahang	87.8	70.0	78.9	90.8	65.9	83.8	73.9	81.8		1.39	35.3	0.40	11	9		1		233.50	8.34	
Bayan Lepas, Penang	90.5	74.9	82.7	94.8	72.0	87.3	77.4			6.24	158.5	3.20	12	11	5			257.55	9.20	
Malacca	91.1	74.2	82.7	93.5	71.7	83.9	76.0			3.63	92.2	0.60	8	8	1			235.95	8.43	
Mersing, Johore	84.7	73.5	89.1	86.3	68.8	81.4	78.1			1.89	48.0	1.20	4	4				242.15	8.65	
Alor Star, Kedah	95.1	71.9	83.5	97.7	69.5	93.0	74.8			1.97	50.0	0.76	8	6		3		266.80	9.53	
Kota Bharu, Kelantan	87.7	72.8	80.3	90.0	69.2	84.2	78.0	87.8	86.2	0.64	16.3	0.27	6	4		2		254.40	9.09	
K. Trengganu, Trengganu	86.0	73.3	79.7	88.7	70.3	83.3	77.3			1.24	31.5	0.93	6	3		6		257.55	9.20	
Singapore	88.7	74.8	87.7	92.0	72.8	83.4	76.7			2.38	60.5	1.12	10	7	4			212.10	7.57	
HILL STATIONS																				
Cameron Highlands, Tanah Rata, Pahang. (3750 ft.)	74.6	53.0	63.0	79.8	45.0	68.0	59.8			2.58	65.5	0.86	8	7				209.55	7.48	

Compiled from returns supplied by the Malayan Meteorological Service.

METEOROLOGICAL SUMMARY, MALAYA, MARCH, 1959

Locality	Air Temperature Degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes				At 1 foot	At 4 feet	Total		Most in a day	Number of Days					Total	Daily Mean	Per cent.
	A. Max.	B. Min.	Means of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.					Amt.	Precipitation .01 in. or more	Precipitation .04 in. or more	Thunderstorm	Fog morning obs.	Gale force 8 or more			
								o F	o F	in.	mm.	in.						hr.	hr.	
Ipoh, Perak	93.8	73.2	83.5	97.4	69.9	84.3	78.5			5.85	148.6	1.57	16	13	3			212.75	6.86	
Kuala Lumpur, Selangor	92.3	74.0	83.1	95.4	71.9	85.7	76.2			11.95	303.5	2.58	22	18	13	3	2	210.25	6.78	
Sitiawan, Perak	90.4	73.4	81.9	95.7	71.2	86.9	75.8	84.7	85.6	9.78	248.4	3.10	18	14	4	2		212.35	6.85	
Kuantan, Pahang	88.8	71.2	80.0	93.1	65.0	81.2	75.0	83.2		9.15	232.4	2.78	13	11	2			199.10	6.42	
Bayan Lepas, Penang	90.1	74.7	82.4	94.9	72.1	84.8	77.9			4.19	106.4	1.63	15	12	8			234.95	7.58	
Malacca	91.0	74.0	82.5	94.9	69.2	84.4	77.2			7.76	197.1	1.81	11	9	6			192.30	6.20	
Mersing, Johore	84.9	74.0	79.5	86.9	68.6	80.2	78.8			15.69	398.5	4.27	15	12				196.80	6.36	
Alor Star, Kedah	94.8	72.6	83.7	99.4	69.3	87.6	76.3			10.31	261.9	2.06	15	14	9			253.75	8.18	
Kota Bharu, Kelantan	87.5	73.8	80.7	90.0	69.8	81.6	80.1	87.8	87.7	8.68	220.5	5.88	12	10	4			237.70	7.67	
K. Trengganu, Trengganu	86.5	73.4	79.7	88.8	69.9	81.3	77.8			8.09	205.5	2.83	11	10		1		231.45	7.47	
Singapore	88.0	74.4	81.2	92.2	70.5	79.7	78.1			9.83	249.5	2.09	13	13	7			162.65	5.25	
HILL STATION																				
Cameron Highlands, Tanah Rata, Pahang. (4750 ft.)	74.1	54.1	64.1	77.0	45.0	70.0	63.0			9.54	242.3	1.69	18	16				169.10	5.45	

Compiled from returns supplied by the Malayan Meteorological Service.

METEOROLOGICAL SUMMARY, MALAYA, APRIL, 1959

Locality	Air Temperature Degrees Fahrenheit							Earth Temperature		Rainfall									Bright Sunshine		
	Means of			Absolute Extremes				At 1 foot	At 4 feet	Total		Most in a day	Number of Days						Total	Daily Mean	Per cent.
	A. Max.	B. Min.	Means of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.						Precipitation .01 in. or more	Precipitation .04 in. or more	Thunderstorm	Fog morning obs.	Gale force 8 or more				
								° F	° F	in.	mm.	Amt.							hr.	hr.	
Ipoh, Perak	92.9	74.1	83.5	96.0	71.4	86.8	76.6			9.44	239.8	2.55	19	15	7				210.50	7.02	
Kuala Lumpur, Selangor	91.4	74.5	82.9	95.0	72.4	87.1	77.3			11.25	285.8	2.23	20	17	17	8			183.00	6.10	
Sitiawan, Perak	89.1	73.9	81.5	91.3	70.0	84.9	75.9	83.8	84.5	9.60	243.8	2.58	21	18	7	13			204.30	6.81	
Kuantan, Pahang	88.9	72.5	80.7	94.1	69.2	81.1	76.6	83.7		5.50	139.7	1.13	14	12	3	3			221.00	7.37	
Bayan Lepas, Penang	89.7	75.3	82.5	90.0	73.5	84.4	77.2			4.39	111.5	1.22	16	14	7		1		233.15	7.77	
Malacca	88.9	73.9	81.4	92.8	72.0	86.0	75.3			11.96	303.8	4.91	19	13	4				184.70	6.16	
Mersing, Johore	86.6	72.7	79.7	89.5	70.0	78.6	75.5			5.88	149.4	2.55	9	9			1		220.70	7.36	
Alor Star, Kedah	92.3	73.8	83.1	95.5	71.4	87.2	77.5			3.76	95.5	1.35	10	9	7				252.90	8.43	
Kota Bharu, Kelantan	89.2	73.8	81.5	91.2	68.6	85.2	76.5	88.8	87.9	2.79	70.9	1.26	8	6	1	2			278.90	9.30	
K. Trengganu, Trengganu	87.8	73.7	80.7	90.5	70.8	84.0	77.3			3.19	81.0	1.65	10	18		3			262.25	8.74	
Singapore	87.7	75.1	81.4	92.5	72.8	80.2	78.3			7.81	198.4	2.53	15	14	7	1			141.10	4.70	
HILL STATION																					
Cameron Highlands, Tanah Rata, Pahang. (4750 ft.)	74.1	56.9	65.5	78.0	52.4	70.0	63.4			10.94	277.9	2.32	22	20					134.20	4.47	

Compiled from returns supplied by the Malayan Meteorological Service.

The NEW 65

It's a FERGUSON SYSTEM Tractor with MORE power!

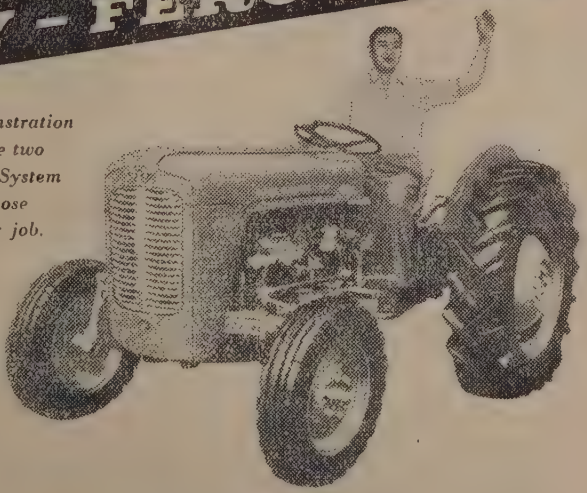
This useful "big fellow" is newly offered additional to Malaya's favourite, the MF 35 as "The bigger tractor for the bigger job."

The FERGUSON SYSTEM

MASSEY-FERGUSON

35

Ask for a demonstration — compare these two great Ferguson System tractors and choose the one for your job.



Once again go years ahead with Massey Ferguson-manufacturers of the latest and greatest in Agricultural equipment.

BORNEO MOTORS

Singapore, Kuala Lumpur, Ipoh, Malacca, Penang, Seremban, Butterworth, Jesselton, Kuala Belait, Kuching.

BIAN HENG & CO., LTD.

(SPECIALIZED IN FERTILISERS)

ALL ANALYSIS ARE GUARANTEED
ACCORDING TO SPECIFICATION.

HEAD OFFICE:

137-A, Cecil Street, Singapore, 1. Tel. 25663.
Tel: 26281 & 32351. Ext. 20. P.O. Box No. 2745.

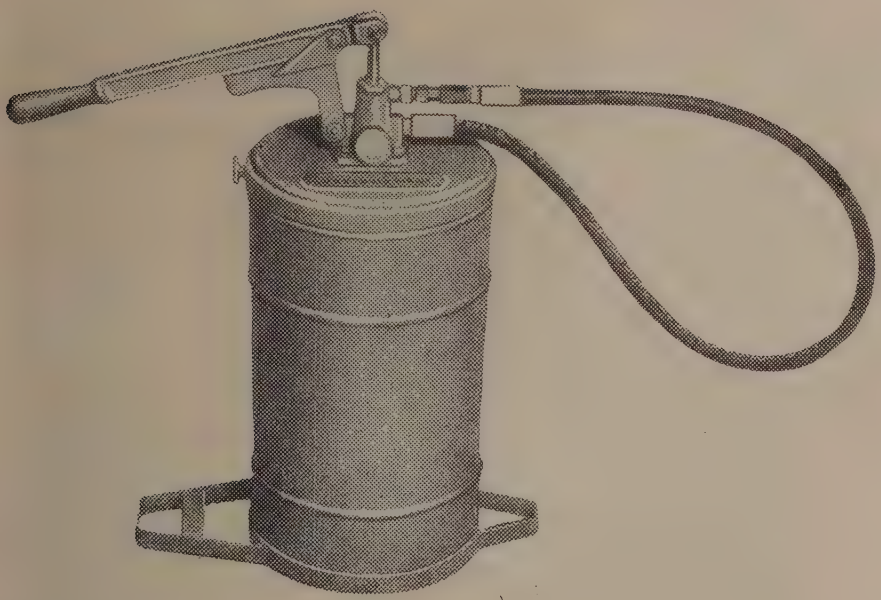
Sub Office:

295, Paya Lebar Road (Junction of Air Port Road) Singapore-19. Tel: 89489.
Tampin:— Tel:43.
Singapore (Kranji) Works Godown:— Tel: 69143.
Seremban Works Godown:— Tel: Seremban 1500.
Petaling Jaya Godown:— Prai Works Godown:— Tel: Prai 209.

Mr. Wee Sue Hang (Kelantan Representative)
339-D, Jalan Sultanah Zainab, Kota Bahru. Tel: K.B. 434.

We assure all our customers, however small or big, of our prompt service and courteous attention at any time.

WAKEFIELD TRACTOR LUBRICATOR



Although the prime object of this equipment is to provide an over-size grease gun for lubricating agricultural and industrial tractors, its particular characteristics have created for it a market in a far wider field. It is transportable and hand-operated, and is therefore a completely self-contained unit of 28 lbs. (grease) or 4 gallons (oil) capacity. It is capable of handling self-levelling greases and all classes of oils, and provides a delivery pressure of 4,000 lbs. p.s.i. if necessary. Up to 500 lbs. p.s.i., the pump is double acting, but a relief valve is provided which at higher pressures frees the return stroke enabling pressures to be built up to a maximum of 4,000 lbs. p.s i. on the down stroke. A 4 ft. length of hose is normally provided and is adequate on the majority of tractors, but if necessary an 8 ft. length can be supplied.

Any estate or mine with a small fleet of vehicles will find this equipment an efficient chassis lubricator providing high pressure lubrication at a moderate cost, while furthermore it ensures a clean supply of grease to the grease point and avoids the continual refilling which a small capacity grease gun requires. The hose is fitted for various types of adaptors which can be interchanged instantaneously without the use of spanners.

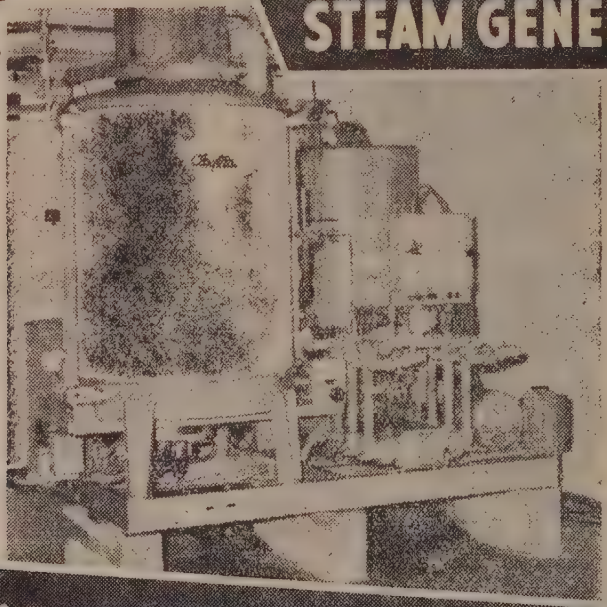
WAKEFIELD
LUBREQUIPMENT

C. C. WAKEFIELD & CO., LTD.,
KUALA LUMPUR — SINGAPORE — PENANG

A.103A-38

Clayton

STEAM GENERATORS



More steam faster... at less cost.

This 75 h.p. Clayton Steam Generator raises steam for laboratory processes connected with rubber research at the Rubber Research Institute, Kuala Lumpur.

For further information on Clayton Steam Generators from 15 to 100 h.p., contact the Sole Agents:—

UNITED ENGINEERS LIMITED

SINGAPORE . KUALA LUMPUR . IPOH . PENANG . MALACCA . SANDAKAN

Ransomes

THE GREATEST NAME FOR MOUNTED IMPLEMENTS

C69 TOOLBAR

a heavy duty implement which is outstanding among toolbars. The bar itself, of immense strength, can be supplied in lengths of 11 ft., 8 ft. 4 ins. and 7 ft. Tools are available for cultivating, mouldboard or disc ridging, disc bedding, subsoiling.

THR 3002
DISC HARROW

Ideal for use in plantations and between crops planted in rows about 6′ apart, For discing-in and breaking down hard lumpy soil. Plain or cutaway discs, 22″ dia. spaced at 9″.

Ransomes

Famous Throughout The World For Agricultural Machinery

SIME DARBY TRACTOR DIVISION,

P.O. Box 252, KUALA LUMPUR. Tel. 88911/8.

RANSOMES SIMS & JEFFERIES LTD., IPSWICH, ENGLAND

NEW PUBLICATIONS OF THE INDIAN CENTRAL COCONUT COMMITTEE

(1) The Coconut Palm — A Monograph :

Compiled by Dr. K.P.V. Menon, Director, Central Coconut Research Station, Kayangulam, and Dr. K.M. Pandalai, Joint Director, Central Coconut Research Station, Kasaragod, "The Coconut Palm—A Monograph" is a comprehensive treatise on all problems connected with the coconut industry and fills a long gap in scientific information that has accumulated in coconut research during the last two decades.

The book contains 384 pages of size 8¾" x 11½", 150 illustrations and 19 colour plates. It has been priced at Rs. 43/- Sh. 90/- $13.00 (including postage, packing and forwarding charges) a copy.

(2) The Coconut Atlas of India :

A beautifully illustrated publication containing maps, charts and graphs depicting in a simple and effective manner acreage and production of coconuts in India and the world, trends in import and export and trends in prices of coconut, copra and coconut oil in India and some of the important coconut growing countries of the world.

Beautifully printed on offset paper with rexine cover the book contains 88 pages of size 11½" x 9" and is priced at Rs. 18/- Sh. 40/- 36.00 (including postage, packing and forwarding charges) a copy.

For copies please write to:—

THE SECRETARY,
Indian Central Coconut Committee,
Ernakulam.

NEW PUBLICATIONS

"West Johore Coconut Production Survey"

Bulletin No. 104, by T.B. WILSON, Agricultural Economist.

This Bulletin, covering one quarter of Malaya's total Coconut acreage, contains factual information on falling productivity and recommendations for the rehabilitation of the area.

Price $1.25 or 3 shillings (Sterling)

"Reconnaissance Soil Survey of Trengganu"

Bulletin No. 105, by Wm. P. PANTON, Geologist.

A limited number of copies of this Bulletin will be available to the public. It contains a new set of soil maps for the area and a detailed description of the soils to be found in the region surveyed, with illustrations.

Price $6.00 or 14 shillings (Sterling)

"Mineral Deficiency Symptoms of Cacao Grown in Sand-Culture"

Bulletin No. 107, by Dr. R.G. LOCKARD, P. VAMATHEVAN and S. THAMBOO.

Thi Bulletin contains the results of experiments on deficiencies and interactions of macro and micro nutrient elements, with illustrations in colour and black and white.

Price $4.00 or 9s. 6d. (Sterling)

Available from:-

THE DEPARTMENT OF AGRICULTURE,
Federation of Malaya,
Kuala Lumpur.

Wiping makes doubly sure..

The spread of lallang demands vigorous measures for control. Spraying and wiping with Shell Lallang Oils will destroy lallang and render ground ready for replanting. This is the surest and safest method. Whatever the method employed, it is necessary to spray and wipe with Shell Lallang Oils to complete the destruction. Make *sure* of control by spraying and *doubly sure* of eradication by wiping with . . .

SHELL LALLANG OILS

SHELL

Twenty four hours

Termites work every minute in their search for food, doing untold damage to young rubber. Most of their damage is done below ground and prompt action must be taken to stop the invasion immediately it is discovered. Dieldrin is the answer to this problem. Used as a spray, Dieldrex 15, an emulsible form of dieldrin, at the rate of 2 fluid ounces to 3½ gallons of water, will exterminate termites. The residual effect is long lasting.

For further information on pest control, please consult your nearest Shell branch.

the ideal estate insecticide **Dieldrex 15**

SHELL

AVAILABLE PUBLICATIONS OF THE DEPARTMENT OF AGRICULTURE, FEDERATION OF MALAYA.

LEAFLETS (Issued free for circulation in the Federation of Malaya only)

AGRICULTURAL SERIES

No. 1. Derris. (1948). E.
4. Groundnuts. (1949). E
9. Pepper. (1956). C M E
25. Manila Hemp. (1947). E
26. The Black Beetle. (1947). E
28. Ramie. (1950). E
29. The Coconut Leaf Moth. (1951). E
30. Fermentation and Drying of Cacao Beans. (1956). E
31. Cacao. (1955). C M E
32. The Establishment and Maintenance of Fruit Trees. (1956). C M
33. Patchouli. (1957). C M E
34. Oil Palm. (1956). E
35. Home Canning and Jam Making. (1957). C M E
36. The Pineapple in Malaya. (1958). C
37. Coffee. (1958). C M E
38. Grow Your Own Nutritious Vegetables. (1958). M E
39. Soil Conservation and Erosion Control. (1958). C M E
40. Compost. C M E

POULTRY LEAFLETS

No. 1. Systems of Poultry Keeping. (1954). C M E
2. The Housing of Poultry. (1955). C E
3. The Feeding of Poultry. (1954). C M E
4. The Choice of Stock. (1955). C E
5. Duck Keeping. (1958). C M E

M = printed in Malay. C = printed in Chinese. E = printed in English.

RECENT BULLETINS

104. West Johore Coconut Production Survey (1958). $1.25.
105. Reconnaissance Soil Survey of Trengganu (1958). $6.
106. Patanga Succincta (L.), The "Bombay Locust", in Malaya. (1959). $2.
107. Mineral Deficiency Symptoms of Cacao grown in Sand-culture. (1959). $4.

SCIENTIFIC SERIES (Discontinued after No. 26)

No. 2. Investigations on Panama Disease in Malaya. (1930). $1.
3. An Historical Note on *Tirathaba rufivena* Walk. (The Greater Coconut Spike Moth) and its Three Parasites in Malaya, and Preliminary Observations on *Sogata* spp. Pests of Padi. (1930). 50 cents
4. Bionomics and Control of *Leptocorisa acuta* Thunb. (1930). $1.
9. Hydnocarpus Oils in Malaya. (1932). 50 cents.
10. An Examination of the Geology and Soils of an Area in the State of Perak, F.M.S. (1932). 50 cents.
11. Lac in Malaya (Part I). (1933). 50 cents.
15. Notes on Hymenopterous Parasites of Padi Pests in Malaya. (1934). 50 cts.
16. The Toxic Value of *Derris* spp. (1935). 50 cents.
17. The Termite, *Microtermes pallidus* Hav., in Relation to Tea in Malaya. (1936). 50 cents.
18. The Oriental Migratory Locut (*Locusta migratoria manilensis* Meyen) and the Bombay Locust (*Patanga succincta* L.) in Malaya. (1936). 50 cents.
19. Lac in Malaya (Part II). (1937). 50 cents.
20. Insects, Fungi and Bacteria Associated with Copra in Malaya. (1937). 50 cents.
21. Observations on Stem-Rot of the Oil Palm. (1937). 50 cents.
22. The Identification of Grubs from Rubber Estates. (1939). 50 cents.
23. Malayan Food Composition Table. (1949). $2.
24. Fodders and Feeding Stuffs in Malaya. (1951). $5.
25. Rice Variety Trials in Malaya, 1947-50. (1953). $5.
26. Rice Variety Trials in Malaya, 1950-54. (1955). $5.

GENERAL SERIES (Discontinued after No. 32)

No. 2. The Brazil Nut in Malaya. (1930). 50 cents.
9. The Cultivation and Manufacture of Tea in Ceylon and India. (1932). $1.
10. Insects of Coconuts in Malaya. (1932). $1.50.
23. The Coconut Industry of the Philippine Islands. (1936). 50 cents.
28. The Practical Aspects of Copra Deterioration. (1937). 50 cents.
29. The Cultivation of Lowland Tea at the Central Experiment Station, Serdang. (1937). 50 cents.
31. Malay Leaf and other Vegetables and their Analyses. (1940). 50 cents.
32. The Pineapple Industry of the Hawaiian Islands. (1949). $5.

ECONOMIC SERIES (Discontinued after No. 15).

MECHANISATION SERIES (Discontinued after No. 1).

No. 1. Investigations into the Mechanical Cultivation of Padi in Malaya. (1951). $2.

DEPARTMENT OF AGRICULTURE, FEDERATION OF MALAYA.

The Director of Agriculture invites those interested to visit the College of Agriculture, Serdang, Selangor, and the various Federal and State Stations throughout the Federation Malaya. Intending visitors to the College of Agriculture should communicate with the Principal; to the Federal Experiment Station, Serdang, Selangor, with the Agronomist-in-charge; and to other Federal and State Stations with the State Agricultural Officers. The following is a list of Agricultural Stations on which can be studied the more important lines of investigation and extension at present carried out by the Department.

Correspondence concerning the experiments at any of these Stations should, if it originates in Malaya, be addressed to the State Agricultural Officer, concerned; correspondence originating in any other country should be addressed to the Director of Agriculture, Federation of Malaya, Kuala Lumpur.

Wet Padi.

SELECTION WORK. Telok Chengai, Kedah; Titi Serong, Simpang Tiga and Talang, Perak; Pulau Gadong, Malacca; Kota Bharu and Jelawat, Kelantan; Kendong, Ulu Klawang and Ampang Tinggi, Negri Sembilan; Tangkak, Johore; Genting and Bukit Merah, Penang and Province Wellesley; and other State Stations.

AGRONOMIC INVESTIGATIONS. Most Padi Experiment and Test Stations.

PADI MECHANISATION SCHEME, Parit, Perak.

Dry Padi.

Melor, Kelantan, and Paya Besar, Pahang.

Rubber.

Budwood and clonal seedling nurseries. Most State Agricultural Stations. Replanting demonstration plots in all States.

Tea.

Federal Experiment Stations, Cameron Highlands and Serdang.

Oil Palm.

Federal Experiment Stations, Serdang, Selangor, and Jerangau, Trengganu.

Coconut.

Federal Experiment Station, Telok Bharu, Perak, and Coconut (Rehabilitation) Station, Sungei Sudah, Muar, Johore.

Cacao.

FEDERAL EXPERIMENT STATIONS. Serdang, Selangor, and Jerangau, Trengganu.

AMELONADO SEED GARDENS. Sik, Kedah; Batang Merbau, Kelantan; Ayer Itam, Penang; Layang Layang Kiri and Bukit Gantang, Perak; Temerloh, Kuala Lipis and Pekan, Pahang; Ampang Tinggi, Negri Sembilan; Sungei Udang, Malacca; Ayer Hitam, Tangkak, Johore; Sungei Tong, Trengganu.

Pineapple.

Jalan Kebun, Selangor, and Alor Bukit, Johore.

Manila Hemp.

Federal Experiment Station, Serdang, Selangor; Degong, Perak; and Sungei Ruan, Pahang.

Fruit Propagation.

Federal Experiment Station, Serdang, and all State Agricultural Stations.

Vegetables.

Federal Experiment Stations, Kuala Lumpur and Cameron Highlands.

Poultry.

Federal Experiment Station, Cameron Highlands and most State Agricultural Stations.

Livestock.

PIGS: Federal Experiment Stations, Serdang and Cameron Highlands; Sungei Buloh and Jenjarom, Selangor; Mah San, Negri Sembilan; Raja Hitam (Dindings) and Teluk Bharu, Perak; Pulau Gadong, Malacca; and Ayer Itam, Penang.

GOATS: Ayer Itam, Penang; Bukit Mertajam, Province Wellesley; Sungei Udang, Malacca; Cheras, Setapak, Sabak Bernam and Federal Experiment Station, Serdang, Selangor; Chembong, Negri Sembilan.

Pastures.

Federal Experiment Station, Serdang, Selangor.

PRINTED BY THE ECONOMY PRINTERS LTD., KUALA LUMPUR.